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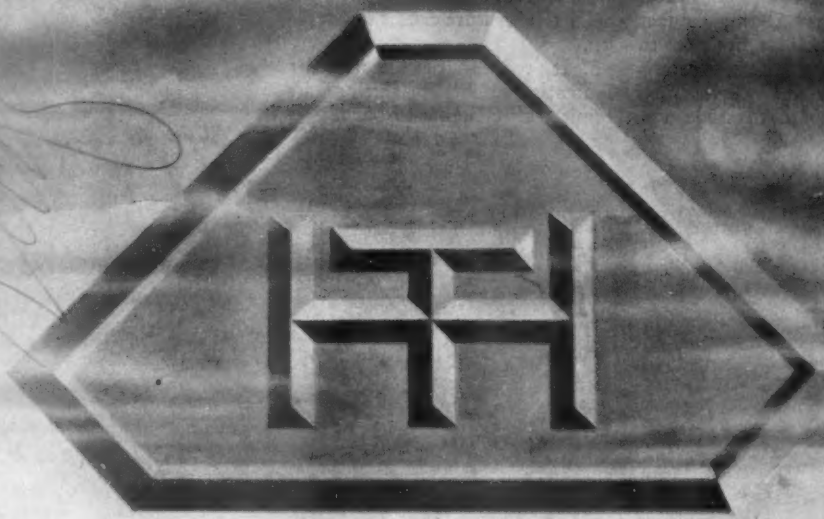

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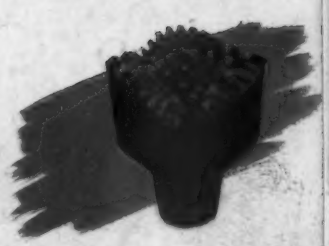

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The cut-a-way view at the right of the Wiggins high-deck design Pontoon Roof shows some of the features which make this roof so effective in preventing evaporation losses from working or blending tanks handling volatile liquids.

The roof floats directly on the liquid blanketing the surface at all levels. The seal which closes the space between the roof and the tank shell on butt-welded tanks consists of a single continuous shoe, that forms a long sliding contact with the tank shell. It fits close to the tank shell at all times. There is also a secondary seal which is fastened to the top of the shoe and rubs gently against the tank shell.

Wiggins Pontoon Roofs less than 60 ft. in diam. have an outer pontoon which is located beneath the deck plating. The larger roofs also have a circular pontoon in the center on *top* of the deck plating.

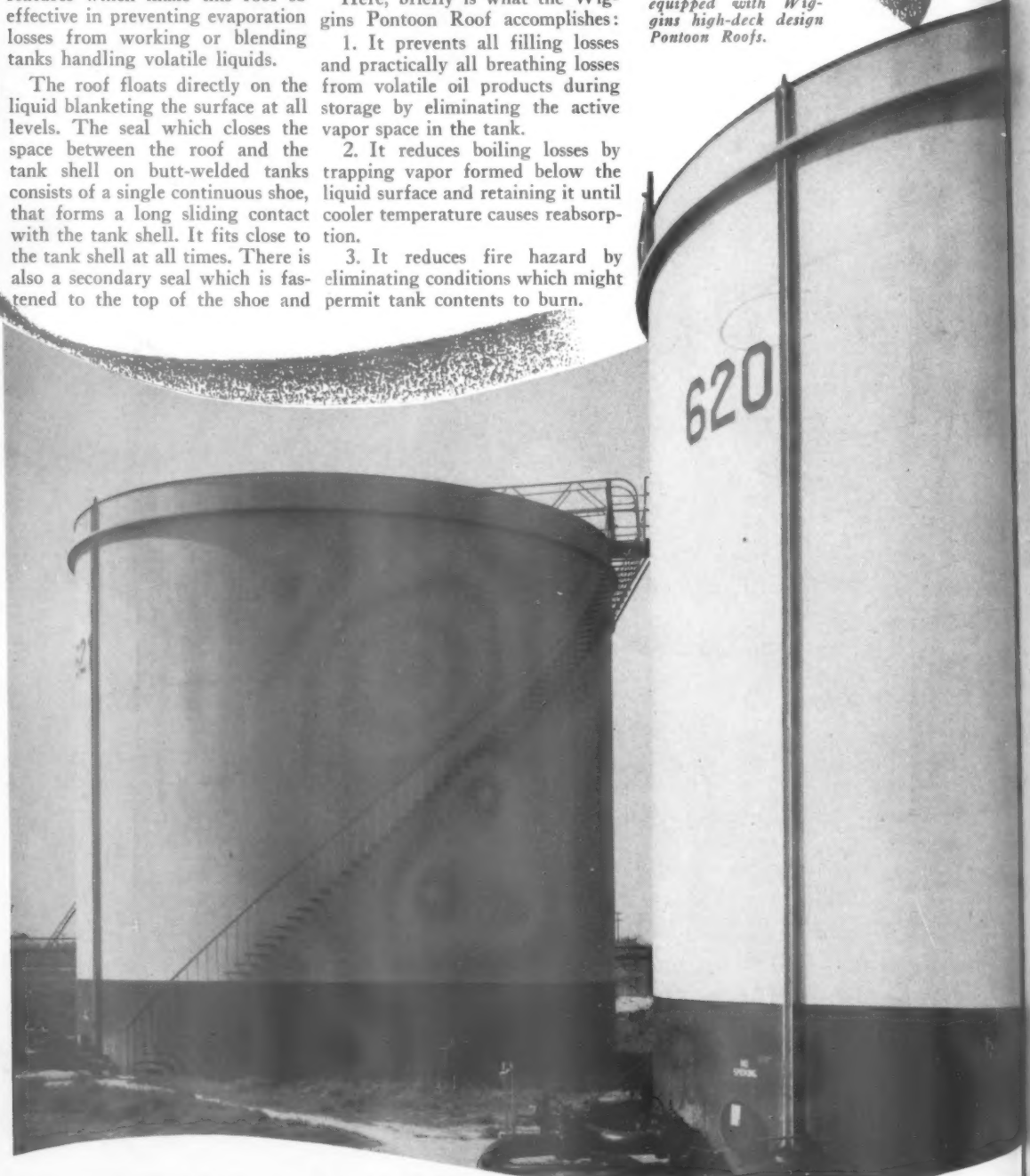
Here, briefly is what the Wiggins Pontoon Roof accomplishes:

1. It prevents all filling losses and practically all breathing losses from volatile oil products during storage by eliminating the active vapor space in the tank.

2. It reduces boiling losses by trapping vapor formed below the liquid surface and retaining it until cooler temperature causes reabsorption.

3. It reduces fire hazard by eliminating conditions which might permit tank contents to burn.

The photo below shows two 48-ft. diam. tanks equipped with Wiggins high-deck design Pontoon Roofs.



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Trends

Crude-Oil Production
By States—Page 154

CRUDE-OIL STOCKS 223,474,000 bbl. as of April 28—up 545,000 bbl. One year ago 235,342,000 bbl.

GASOLINE STOCKS 94,068,000 bbl. as of April 28—down 1,036,000 bbl. One year ago 88,305,000 bbl.

RESIDUAL FUEL-OIL STOCKS 39,813,000 bbl. as of April 28—down 679,000 bbl. One year ago 50,631,000 bbl.

GAS OIL AND DISTILLATE STOCKS 28,273,000 bbl. as of April 28—up 54,000 bbl. One year ago 30,146,000 bbl.

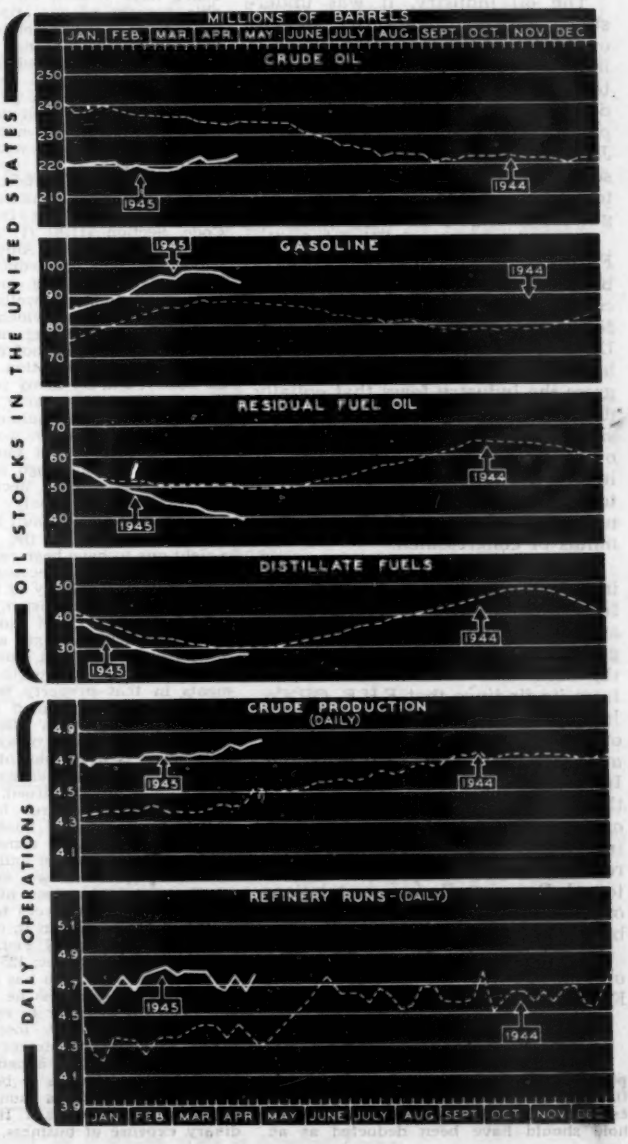
CRUDE OIL PRODUCTION 4,836,850 bbl. as of May 5—up 24,850 bbl. One year ago 4,528,850 bbl.

REFINERY RUNS 4,780,000 bbl. daily week ended April 28—up 104,000 bbl. One year ago 4,329,000 bbl.

ESTIMATES came from Washington this week that end of the European war will permit increased allocation of gasoline to civilian drivers to the extent of 100,000 to 200,000 bbl. daily. These figures, of course, are less than the Petroleum Industry War Council economics committee calculated in its most recent long-term report. PIWC studies indicated that defeat of Germany would permit an increase to civilian drivers of approximately 250,000 bbl. daily, although several economists have taken exception to the more liberal viewpoint. Petroleum Administrator Ickes, however, was quoted in news dispatches as saying a liberalization of civilian rations would probably amount to 50 per cent increase for A-card drivers. Subsequent information from Washington indicates, however, that a rise of 35 to 40 per cent in basic A coupon values will be more in keeping with the final adjustments.

AN increase of 200,000 bbl. daily in the supply of civilian gasoline available for rationing, the Office of Price Administration estimates, will permit a rise of 1 gal. per week in the A-card allocation. This would indicate that 8,400,000 passenger vehicles in the United States are operated exclusively on minimum rations, assuming that OPA intends to earmark the entire tentative increase for drivers in the A classification. This increased motor-fuel allocation, of course, theoretically would permit 780 miles of additional driving per year. In actual practice, however, OPA has indicated that B-card drivers will be permitted slight increases in occupational motor fuel thus cutting into the additional supply available for allocation to basic A coupon holders.

RECENT motor-vehicle registration figures from the Bureau of Public Roads shows that the number of privately owned automobiles in 1944 declined to 25,466,331, a decrease of 446,339 or 2 per cent. Most of the cars retired from service, it is indicated, are those which have sifted down into hands of A-card operators. Since the all-time peak of 29,524,101 privately owned passenger cars were registered in 1941 there has been a decrease of 4,057,770 automobiles, a reduction of nearly 14 per cent. This process of car retirement with no replacements is continuing at an accelerated rate and is a contributing factor to probable relaxation of gasoline rationing.



Privilege Restored for Deducting Intangible Drilling Expenses

NEW ORLEANS. — The option to deduct intangible drilling costs for income tax purposes was officially restored to the industry here last week by the Fifth Circuit Court of Appeals which recast its earlier upsetting decision in the F.H.E. Oil Co. case. Actually, the disturbing opinion prohibiting deduction of intangible drilling costs, had not been applied because the Treasury Department elected to stand by its regulation until the issue was clarified either by the Supreme Court or by Congress.

The oil industry, it was understood, will continue active support of the Doughton resolution which is intended to end all doubt on the intent of Congress on the matter of deducting intangible drilling expense. The resolution (see May 5 Journal, page 69) represents consensus of the industry on how best to clarify intent of Congress for guidance of the judiciary.

Damaging potentialities of the Fifth Circuit's original opinion have been effectively removed by the court's self-imposed limitations affirming holdings in the F.H.E. case. Until the intangible deduction privileges are clearly established by Congress the industry fears that equally disturbing or more damaging decisions may come unexpectedly from other circuit courts. Therefore, oil industry attorneys argue, the time to seek permanent clarification is now while the issue is fresh in the minds of congressmen.

Twenty-one attorneys, representing a cross section of the industry, filed a long brief of amici curiae and F.H.E. counsel submitted an argument appealing for rehearing of the suit. The court did not retire from its findings that F.H.E. Oil Co. improperly deducted the expense of one well drilled as part consideration for acquisition of a leasehold. In affirming its decision, however, the court narrowed its opinion to the one set of circumstances surrounding F.H.E. arguments. The court recognized propriety of following Internal Revenue Bureau regulations on drilling operations which it embraces.

Complete text of the court's ruling on the appeal for rehearing the F.H.E. case follows:

Complete Text of Ruling

"A vigorous motion for rehearing, supported by an exhaustive brief, contends that the decision is wholly wrong, and especially that the cost of drilling the dry hole should have been deducted as an expense of business or as a loss realized. Upon an assertion that the whole oil-producing business is affected by the argument of our opinion to the effect that the option to deduct the drilling cost of a successful well, as given by regulation of the Treasury Department, is contrary to the statute and wholly void, we permitted briefs to be filed by 30 counsels for other oil producers as amici curiae.

"No new and controlling decisions are cited. It still appears that only the Tenth Circuit has squarely considered the validity of the option in the light of the statute and has sustained it, and that was before the introduction into the statute of percentage depletion on oil wells. With this exception all the appellate courts, including the Supreme Court and this court, have treated the option as allowable, because no one attacked it. The decisions about other related provisions of the regulations are not in point. They express no considered opinion on the option itself. What is new in the briefs is the assertion, which we take to be true, that probably a billion dollars of corrections might result in expense deductions in tax returns made within the statutes of limitation, if the option is invalid. Also new is the contention that in the Second Revenue Act of 1940 there is language now found in Internal Revenue Code, Section 711(b) (1) (I), as amended in the Excess Profits Amendment of 1941, which refers to the deduction in the past of intangible drilling and development costs in drilling oil wells, the argument being that Congress evidently had in mind the option to do this given by the various regulations, and did not disapprove. Certain it is that the option has been acted on widely, and for many years, and courts and Congress have done nothing drastic about it. A total annulment of it, retroactive in its operation, would have grave effect on persons not before this court. We should therefore go no further than our duty takes us in deciding this case; we should decide it only.

"While we see no fault in our previous reasoning, and think the former opinion a right one to have been rendered 20 years ago, we find it unnecessary to consider so broadly the validity of the option, and now confine our decision, as the majority of the Tax Court did, to a holding that wells drilled to get an oil property, or to get a better and more extensive interest in it, are so clearly capital investments in that property that no part of their cost can be called an expense of business. The question whether a successful oil well on property which the driller fully owns is a permanent improvement, as is an artesian water well on a ranch, or a tunnel for a railroad, or the underground part of a large building, in all of which the cost of 'making a hole in the ground' is plainly a part of the capital investment, we can and do lay to one side. The question we must decide is whether one who does not own an oil property and who agrees to make a well to obtain an interest in it, (as in Hardesty vs. Commissioner, 127 Fed. [2] 843, and Hunt vs. Commissioner, 135 Fed. [2] 697), or as in this case, who has an interest for a few days only unless he makes a well, and makes it in order to enlarge and extend his temporary interest, thereby makes a capital investment which cannot be a mere business expense under the statute. The answer is in both cases, yes. He is putting out his money to acquire property, and acquires it. It is not an ordinary expense of business, as these parties asserted it was in their petitions to the Tax Court, and the regulation cannot make it such; or what is worse, give the taxpayer an option to treat it as such.

"Now as to the 'dry hole'. If we were discussing 'permanent improvements', which like other capital investments are not ordinary business expenses, of course the fact that the well did not reach oil and was abandoned would be most material. If one drilled such a well on his own property, he would probably have either a right to a deduction as for an expense or as a business loss, for he has only a valueless 'hole in the ground'. This alternative was claimed in the petition to the Tax Court. It was denied because the well, while drilled on a lease assigned to the taxpayer, was drilled as the consideration for the assignment, the contract binding the assignee to make the well in a stated time, and providing that if he did not his assignment should terminate. He drilled the well as the price of his interest in the property. Although this well failed, he still has the assigned lease. We understand that there are other producing wells on the same lease. But if the property he thus acquired proves valueless, he must realize his loss by a disposition of it, just as though he had paid money for it.

"The motion for a rehearing is denied and the judgment of the Tax Court stands AFFIRMED."

WALLER, Circuit Judge, specially concurring:

"I think that the Tax Court was justified in holding that the cost of drilling a well on each of the nine tracts was a part of the consideration for the assignment of the lease to the taxpayer where, as in this case, the lease could not be kept alive by the payment of an annual rental but required drilling, termination, or reversion within a certain time, so long as the holdings of this Court in Hardesty vs. Commissioner, 127 F. 2d 843, Hunt vs. Commissioner, 135 F. 2d 697, Stansylvania Oil & Gas Co. vs. Commissioner, 135 F. 2d 743, and Walsh vs. Commissioner, 135 F. 2d 701, are unreversed."

.....

Clerk of the United States Circuit Court of Appeals for the Fifth Circuit.

Nation Will Share Pacific War Burden Equitably

WASHINGTON.—The burden of filling Pacific demands for petroleum products for the war against Japan will be equalized throughout the nation, Petroleum Administrator for War Harold L. Ickes said last week.

"We need a lot of oil in the Pacific. It is hard to say whether a temporary or longer restriction will be necessary on the West Coast. It all depends on what we can get out there by tank car on the single-track railroads and by tanker through the Panama Canal," Ickes said.

The Pacific Coast will get the same treatment as the rest of the country, whatever that is, Deputy Administrator Ralph K. Davies added.

Fuel-oil supplies will be about the same as last year. Passenger-car gasoline allotments will be increased 40 to 50 per cent within a reasonable "readjustment" time after V-E Day, Ickes said, confirming an earlier prediction.

V-E Day Brings Refiners Additional Supply Problems

by H. Stanley Norman

TWO supply problems arose this week to confront United States refiners where one previously stood out. End of the European war calls for prompt restoration of civilian, industrial and commercial supplies of petroleum in Europe. Without necessary oil supplies the task of restoring devastated European homes, industrial plants and resuming normal agricultural production will be impossible. Allied nations, industrialists assert, can ill afford to supply more than minimums of food and material for the rehabilitation era and for this reason it is reasonable to assume that oil will be made available to European countries with which to do their own rebuilding.

Immediate assignments of the oil industry are:

1. Substantial increases in production of fuel oil and superior aviation gasoline to maximize naval operations and long range bombing attacks against Japan and enemy positions in China.

2. Shipment of maximum available civilian-grade products to the European continent to hasten restoration of essential facilities.

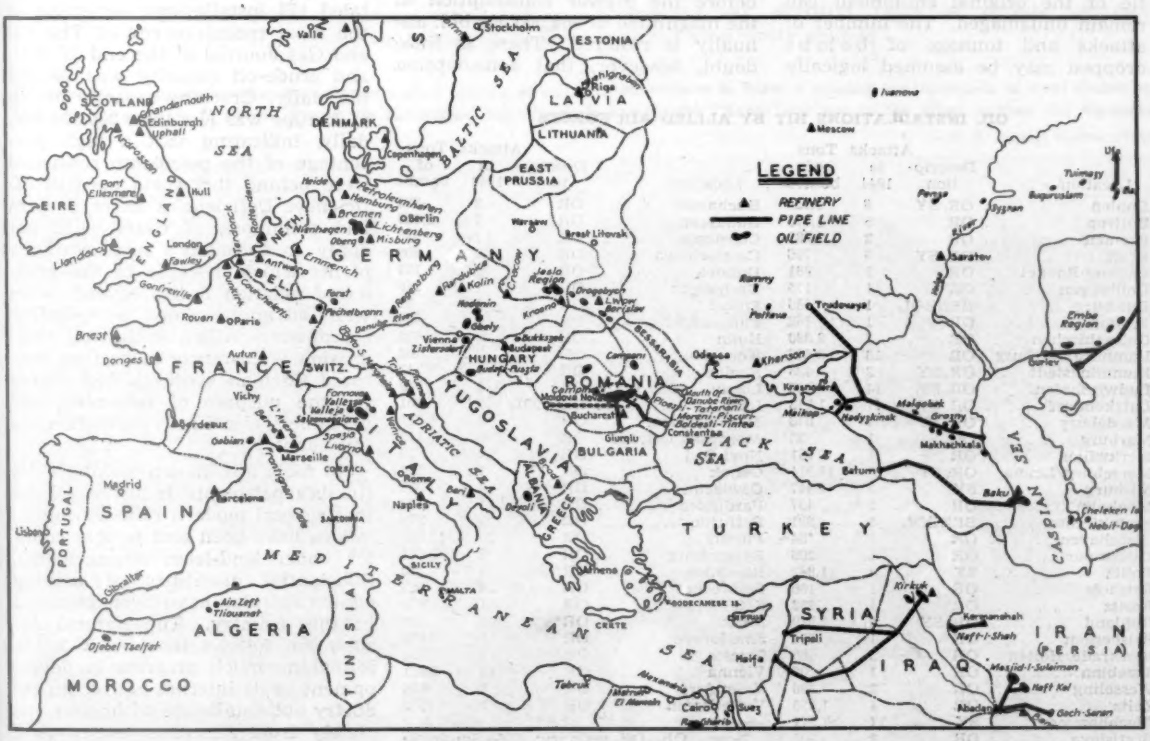
Bulk of the European supply problem will fall on United States refiners until the Japanese war ends, chiefly because many months will be needed to restore European petroleum facilities and resume normal tanker shipments.

Military restrictions still cloak in secrecy complete data on damage to European petroleum facilities. Refineries in southern France, it is known, are virtually intact and can be restored to operation with moderate repairs and providing crude oil can be made available from the Middle East or South America. Refineries in northern France suffered damage ranging from 60 per cent demolition to complete destruction in the German invasion and the subsequent Allied liberation.

Only one refinery in Italy at Bari is known to have escaped serious damage or complete destruction. The Bari installation is primarily a hydrogenation plant built by the Italian Government company several years ago for operation on heavy Albanian crude. Technicians believe the Bari plant could be operated to advantage in supplying civilian products if high-gravity crude can be made available. Military authorities hint that German forces holding northern Italy until closing phases of the war destroyed or stripped refineries in that area. Bombing attacks, it has been previously disclosed, completely wrecked the Naples refineries owned by an Italian subsidiary of Socony-Vacuum Oil Co., Inc. The Naples plant was equipped with one of the few modern catalytic cracking units in prewar Europe.

Likewise, no specific information has been issued by Soviet Russia on condition of Romanian refineries and producing fields. Allied bombing raids on Romanian plants before German forces were driven out are known to have destroyed some of the largest and most modern Romanian refineries. Russia, it is understood, has given its military forces complete authority over Romanian petroleum facilities and that inordinately high quotas of operation have been assigned. Serious doubt is expressed that the Romanian industry can meet the quotas established by Soviet management and fear is expressed that such failure would be followed by replacement of national personnel with Russian workers.

Furthermore, all petroleum producing, refining and distribution fa-



Principal refining centers, pipe-line systems and producing areas of liberated Europe

EUROPEAN CONSUMPTION IN THOUSANDS OF BARRELS ANNUALLY

	1941	1940	1939	1938
Russia	138,500	180,000	170,600	164,500
United Kingdom	32,000	50,000	91,000	92,800
Germany	21,000	35,000	54,000	55,600
Italy	14,180	14,050	21,800	21,000
Romania	11,770	13,077	14,980	14,220
France	10,000	21,500	50,000	54,000
Holland	3,200	5,300	11,800	10,950
Spain	3,020	4,000	4,700	4,000
Sweden	3,000	4,500	10,650	9,900
Eire	1,970	2,100	2,430	2,350
Denmark	1,800	2,900	7,200	6,550
Belgium	1,800	3,300	6,950	6,650
Norway	1,600	2,200	5,130	4,730
Hungary	1,400	1,800	2,090	1,960
Portugal	1,300	1,580	1,650	1,530
Greece	1,000	2,520	2,600	2,490
Switzerland	900	1,900	3,640	3,470
Finland	700	900	2,230	2,070
Yugoslavia	400	1,000	962	965
Poland	*	*	†	†
Czechoslovakia	*	*	*	*
Estonia	213	280	366	350
Malta	207	250	404	380
Bulgaria	175	490	805	785
Latvia	375	168	423	420
Lithuania	120	250	347	330
Total	250,630	349,065	466,777	462,000

*Included with Germany. †Included with Germany and U.S.S.R. Note—Data from A. I. M. E. reports by V. R. Garfias, R. V. Whetsel and J. W. Ristori.

EUROPEAN CRUDE-OIL PRODUCTION

	1944		1943	
	Total (1,000's bbl.)	Daily (bbl.)	Total (1,000's bbl.)	Daily (bbl.)
France	500	1,366	600	1,644
Germany*	18,000	49,180	19,199	52,600
Great Britain	750	2,049	1,095	3,000
Hungary	6,000	16,393	5,658	15,500
Italy†	800	2,188	995	2,725
Romania	29,700	81,147	36,500	100,000
U.S.S.R‡	256,200	700,000	246,375	675,000
Total	311,950	852,323	310,422	850,470

*Includes part of Poland, Austria, and Czechoslavakia; †Includes Albania; ‡Includes part of Poland, and North Sakhalin.

DATA ON EUROPEAN REFINING CAPACITY

Country—	No. plants	Crude oil capacity	Cracking capacity
Austria	5	8,020	750
Belgium	8	10,975	4,300
Bohemia-Moravia	11	12,300	1,100
Denmark	3	620	None
Eire	1	600	None
Estonia (Shale Oil Plants)	4	1,000	None
France	17	156,650	70,600
Germany	31	48,450	6,070
Holland	1	18,000	12,500
Hungary	7	11,670	350
Italy	10	57,300	28,000
Latvia	1	200	None
Norway	1	1,200	None
Poland	19	23,050	2,300
Portugal	1	5,000	1,500
Romania	48	211,300	47,500
Spain	1	1,500	None
Sweden	1	3,500	2,700
United Kingdom (Great Britain)	18	133,450	20,500
Yugoslavia	3	4,800	None
Total	171	709,585	198,170

cilities in Austria, Poland, Czechoslovakia, and eastern Germany are in territory occupied by Soviet forces, leaving doubt as to how they will be used in postwar restoration.

Petroleum refineries and synthetic oil plants in Germany, it is agreed, have been largely destroyed. The accompanying list of plant locations with data on the number of Allied air raids and tonnage of bombs dropped on them indicates that little of the original equipment can remain undamaged. The number of attacks and tonnage of bombs dropped may be assumed logically to index the importance of the Axis installations from standpoints of size and strategic value. European petroleum consumption, estimated at 250,630,000 bbl. in 1941, had been reduced to a rate of perhaps 60,000,000 bbl. during the final stages of the war. Several years may elapse before the prewar consumption in the magnitude of 462,000,000 bbl. annually is restored. There is little doubt, however, that consumption will return to the 1941 and 1940 levels almost as rapidly as the Allied supplying nations permit.

OIL INSTALLATIONS HIT BY ALLIED AIR FORCES

Location—	Description	Attacks in 1944	Tons of bombs
Bohlen	OR, SY	6	1,130
Bottrop	OR	6	1,775
Bremen	OR	2	1,383
Brux	OR, SY	3	796
Castrop-Rauxel	OR	1	361
Dollbergen	OR	1	175
Duisburg	BENZOL	1	136
Freital	OR	1	162
Gelsenkirchen	OR	7	2,320
Hamburg/Harburg	OR	13	8,647
Hammingstedt	OR, SY	3	423
Ludwigshafen	OR, SY	14	6,430
Lutzkendorf	OR, SY	7	1,713
Magdeburg	OR, SY	4	878
Marburg	OR	1	33
Merkwiller	OR	1	261
Merseburg/Leuna	OR, SY	19	12,914
Misburg	SY	9	4,447
Monheim	OR	2	437
Neunkirchen	BENZOL	1	391
Olsbshaven	OR	1	84
Ostermoor	OR	1	206
Politz	SY	4	1,863
Reisholz	OR	1	160
Rositz	OR	1	252
Ruhland	OR, SY	5	919
Salsbergen	OR	1	204
Sterkrade/Holten	OR	2	689
Trzebina	OR	1	109
Wesseling	OR	2	386
Zeitz	OR	4	1,625
Blechhammer	SY	17	7,571
Bratislava	OR	2	505
Brasov	OR	1	426
Bucharest	OR	3	882
Budapest	OR	7	2,657
Constanta	OR	1	315
Czestochowa	OR	1	209
Dubova	OR	1	177
Drohobycz	OR	1	140
Fiume	OR	1	81
Florisdorf	OR	2	462
Kolin	OR	2	623
Korneuburg	OR	2	402
Kralup	OR	1	43
Lobau	OR	1	222
Linz	BENZOL	5	901
Moosbierbaum	OR	5	1,211
Moravska Ostrava	OR	4	115
Novi Sad	OR	1	58
Osijek	OR	1	186
Oswiecim	OR	4	981
Pardubice	OR	1	122
Petfurdo	OR	2	279
Ploesti	OR	19	13,109
Regensburg	OR	6	1,614
Roudnice	OR	1	50
Schwechat	OR	4	527
Sete	OR	1	579
Sisak	OR	1	166
Smedorovo	OR	1	252
Trieste	OR	4	714
Vienna	OR	13	5,821
Vosendorf	OR	2	294
Vinterhafen	OR	2	172

Note: OR—Oil refinery; SY—Synthetic oil refinery.

Prewar Refinery Installations

Prewar European refineries totaled 171 installations, according to the most recent survey of The Oil and Gas Journal at the end of 1941, and crude-oil capacity was 709,585 bbl. daily. Cracking capacity for all of Europe was less than 200,000 bbl. daily, indicating that a high percentage of the petroleum refineries were behind the world pace in efficiency. Deficiencies in equipment and technique, of course, did not apply to Germany's new synthetic plants which, because of the quality of aviation fuel produced, were well advanced from a scientific standpoint. Allied technical commission is currently inspecting captured German synthetic-fuel plants for the purpose of returning any valuable scientific information to this country.

No facts are known about Soviet Russia's petroleum industry, except that several modern refinery installations have been sent to that country under lend-lease arrangements. Substantial quantities of drilling equipment also have been acquired in this country. The natural assumption follows that the U.S.S.R. is making much progress in development of its internal petroleum industry but details are withheld completely from American engineering and manufacturing firms.

THIS WEEK

ACHIEVEMENT—Oil and gasoline flowing into China from Calcutta through world's longest pipe line. . . . Staggering difficulties overcome. . . . Effects tremendous savings in transportation. . . . ¶New-type lubricating oil for jet-propelled aircraft rushed to Army Air Forces. . . . Only one grade needed for all atmospheric conditions. . . . No insulation of oil lines, tanks. . . . ¶Illinois Institute of Technology reports production of 80-octane gasoline by cracking petroleum fractions in presence of aluminum-chloride catalyst. . . . Get gaseous and liquid hydrocarbons wholly free from olefins. . . .

TIRES—Senate committee wants to know reason for carbon-black shortage at this juncture and why output is behind programs for producing other tire components. . . . Had been supposed trouble was caused by manpower and other shortages. . . . Poorer quality of synthetic rubber tires necessitated. . . . Deterioration about 20 per cent on heavy military tires, 30 per cent on civilian. . . . ¶World's largest tires, containing 140 times as much rubber as passenger tires, on production. . . . Weigh more than most automobiles. . . .

COURTS—Supreme Court upholds right of FPC to peg natural-gas price at cost of production. . . . Extends FPC's ratemaking power from end of line to mouth of well. . . . ¶Also refused rehearing of its decision that FPC properly ordered Panhandle Eastern to reduce its interstate wholesale charges. . . . ¶Declined to reconsider decision upholding FPC's order that Colorado Interstate and Canadian River companies reduce rates. . . . ¶Circuit Court at New Orleans modifies previous ruling and accepts view that deduction of intangible drilling costs for tax purposes is legal. . . . Fails to remove necessity of oil industry carrying fight to congress for clarification.

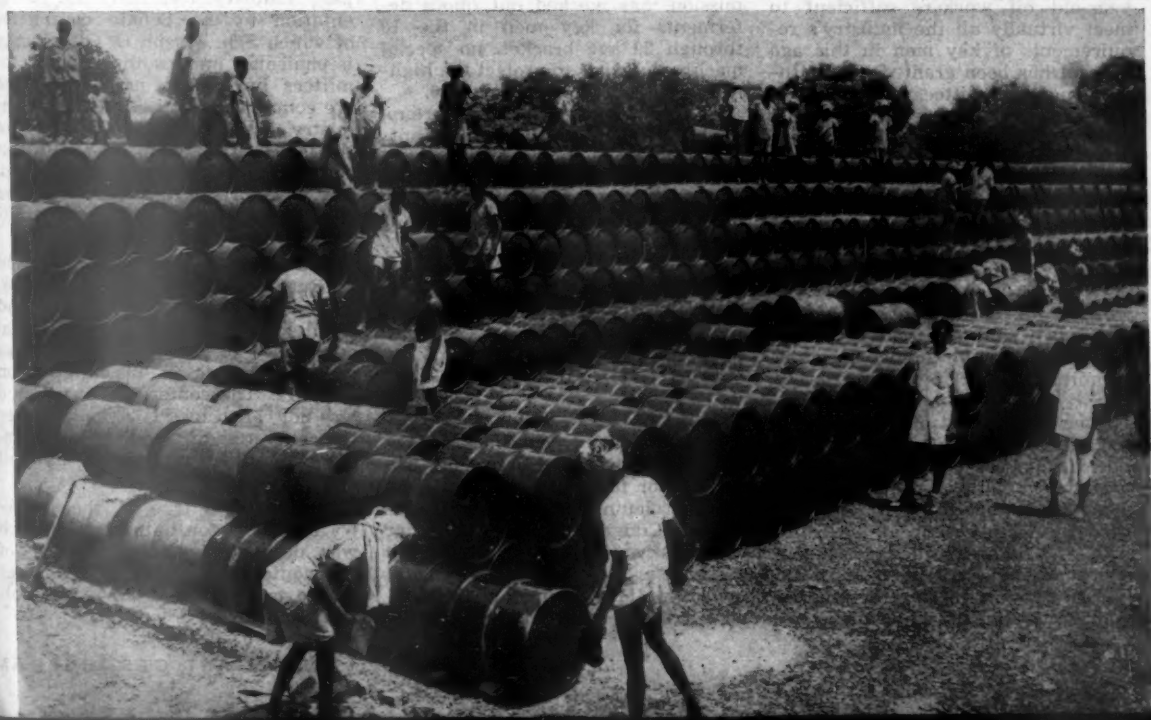
REFINING—District 2 refineries operating under PAW directive to supply specified quantities of Grade 7-0-2-D diesel fuel and Pool 21 distillate fuel oil. . . . Designed to assure war supplies. . . . ¶Prototype oil burner to be developed as model for operation on catalytically cracked fuels. . . . Analogous to reference engine used by automobile manufacturers for testing fuels. . . .

FOREIGN—Three PAW representatives arrive London for sessions United Nations Petroleum Supply Program. . . . To adopt plan for effective supply and distribution of oil from areas in which Americans and British operate. . . . ¶France invited to become fifth full member United Maritime Executive Board. . . . ¶Allied invasion of Borneo and occupation Rangoon bring rich oil, rubber resources within reach. . . . ¶Firmer attitude developing toward Russia regarding Middle East oil. . . . Earlier disposition of other nations to appease is vanishing . . .

STATES—Texas House approves bill increasing gasoline tax 1 cent, making total state tax 5 cents. . . . Would increase Texas revenues $10,000,000. . . . ¶Montana becomes fourteenth member Interstate Oil Compact Commission. . . . Seen as strengthening right of states to self-regulation. . . . ¶Mississippi Oil and Gas Board's effort to draft spacing regulations for gas-condensate wells deadlocked. . . . One side contends compulsory unitization necessary for conservation, but now illegal. . . . Opponents say destroys right of private contract, wouldn't stop waste anyway. . . .

The Large Drum Manufacturing Detachment's plant located at an ATC somewhere in India is turning out thousands of steel drums for shipment of gasoline to China. Planes fly the drums, full of gasoline, over the "Hump" for use in the effort against the Japanese

—U. S. Signal Corps photo



Journal and Petroleo Interamericano Eastern Manager in South America

KENNETH J. LANGLEY, eastern manager for The Oil and Gas Journal and the affiliated bilingual Latin American publication, Petroleo Interamericano, left this week via Pan American clipper for a trip covering important oil countries in South America.

Langley will concentrate on assembly of data on South American operations which are undergoing constant change apace with war events and in preparation for expansion when hostilities cease. He will do research work on operating phases pertinent to a more complete understanding of South American drilling, production, refining and transportation problems.

His trip continues and expands objective of the Journal and Petroleo Interamericano in keeping the editorial and advertising staffs intimately informed on South American operating affairs by on-the-ground observations. Previous trips to Latin American producing countries have been made by C. O. Willson, editor of the Journal; O. B. Irizarry, editor of Petroleo Interamericano; and Mitchell Tucker, manager of research for the two publications.

KENNETH J. LANGLEY

Several years of Langley's service with the Journal and Petroleo Interamericano were spent in the Mid-Continent district. He entered publication activity after working as a petroleum engineer in producing operations.

Deferments Ease Manpower Problem

WASHINGTON.—A quota of draft deferments for 18 through 29-year-old oil workers sufficient to meet virtually all the industry's requirements of key men in this age bracket has been granted by the Interagency Committee, it was learned here this week. The even more critical question of deferments for trained men in the 30 through 37 age group remains unresolved.

Grave concern is felt in industry circles over the growing trend toward reclassification to 1-A status of highly trained men over 30. If the rate of induction parallels the present rate of reclassification, one spokesman said this week, the industry will not be able to meet its commitments for petroleum products.

Some 35 per cent of all oil workers have been drafted, it is estimated. Some 50,000 petroleum industry employes are in the 30 through 37 age group and, it is estimated unofficially, 75 per cent of these are technical, highly skilled or supervisory personnel.

While the Interagency Committee on draft deferments, under the chairmanship of Paul V. McNutt, administrator of the War Manpower Commission, has worked out quota deferments for key men in the 18 through 29 age bracket, no special machinery exists to protect the highly specialized personnel over 30.

In the 18 through 29 age group, the interagency board initially granted a deferment quota of 30 per cent of key personnel. Subsequently, an additional 5,000 men were deferred in the oil industry, plus 100 per cent of the oil men in foreign areas.

Industry Rallies to Ickes' Support

WASHINGTON.—Support for Harold L. Ickes to continue as Secretary of Interior and Petroleum Administrator for War is coming from the petroleum industry and members of Congress who are familiar with his work in connection with the war program of the petroleum industry. It is assumed that President Truman will make several additional changes in his cabinet but he is being asked to continue Ickes in office at least until the war emergency is over. Part of the support emanates from those who differed with the secretary on domestic policies before the war.

W. R. Boyd, Jr., chairman of the Petroleum Industry War Council and president of the American Petroleum Institute who has worked closely with Ickes over the past 4 years, wrote President Truman asking that the Petroleum Administration for War be continued to operate until the close of the war with no changes in the top administration which includes Deputy Administrator Ralph K. Davies. Boyd wrote: "It is, I believe, the sincere and earnest hope of those engaged in the petroleum industry that you will permit the Petroleum Administration for War to function without interruption or change in its directive heads or method of operation until the conclusion of the war, when need for it will have ceased and it can then be dissolved promptly."

It is understood that the representatives of other oil associations here are in agreement that the best interests of the war effort and the petroleum industry will be served through a continuance of the Ickes administration in petroleum matters.

PIWC Not Involved in Senate Hearing Plans

WASHINGTON. — Some of the publicity pertaining to the announcement of the seven industry committees which have been asked to prepare industry testimony for presentation to the Senate committee of which Sen. Joseph C. O'Mahoney is chairman implies that such committees have been named by and are committees of the Petroleum Industry War Council. Such is not the case. The confusion doubtless comes about because W. R. Boyd, Jr., is chairman of the committee of five which named the committees referred to.

The committee of five (composed of Russell B. Brown, J. C. Hunter, J. French Robinson, E. Buddrus and Boyd) was named by an informal conference of some 50 oil and gas men which met in Washington on April 19. The conference mentioned was not called by PIWC and neither the committee of five nor the industry committees named are part of PIWC.

The same is true of the industry committee on natural gas which was designated at the request of the conference mentioned to offer advice to PIWC's National Oil Policy Committee.

Allies Are Smothering Japanese Captured Oil Supplies

OIL and rubber treasures of immense value came within reach of the Allies during the past week with the invasion of Borneo and the capture of Rangoon, capital of Burma, and that country's principal port on the Bay of Bengal. The two operations effect corresponding deterioration of the Japanese position with respect to these war materials.

Important oil fields in the Borneo area include not only Tarakan, with annual prewar production of about 5,000,000 bbl., but Miri, with mare than 1,000,000 bbl.; Seris, near Brunei Bay, 6,000,000 bbl., and Louise, near Balikpapan, 4,000,000 bbl.

An oil rehabilitation crew accompanied the invaders of Tarakan, and these technicians presumably will have the region's wells back on production in a short time. They found the Japanese were blowing up wells with remote-control explosives.

From Tarakan Island and the Borneo fields the war department has estimated that the Japanese obtained 35 per cent of their oil supplies.

Complete destruction of wells and facilities by the Japanese will mean a gap of 6 months to 1 year before an appreciable supply of oil is available. If the properties are recovered without extensive damage, they can soon be put back into operation.

When the Japanese landed in December, 1941, the Balikpapan refinery was completely destroyed, and in the fields many wells were plugged or destroyed. Since January 1942, the Japanese have made every effort to restore the fields, but the Thirteenth Army airforce has bombed installations repeatedly. There were at least four raids on the Balikpapan plant. The Thirteenth also discovered that the Japanese had restored the pipe line running across the Dondang bridge 45 miles north of Balikpapan and destroyed the bridge on December 9, 1944, together with eight oil tanks rebuilt at Sanga-Sanga near the bridge.

The Japanese also reconstructed the Miri (Lutong) refinery. But Liberators destroyed it and fuel storage tanks.

Borneo is second only to Sumatra in potential petroleum output, and it equaled Sumatra in fuel-oil production. Before the war it yielded about one-third of the total output of the Dutch East Indies. Tarakan is a source of the world's purest crude. Its 500-odd wells produce an oil which requires only the simplest treatment, or none at all, before being used for bunker fuel.

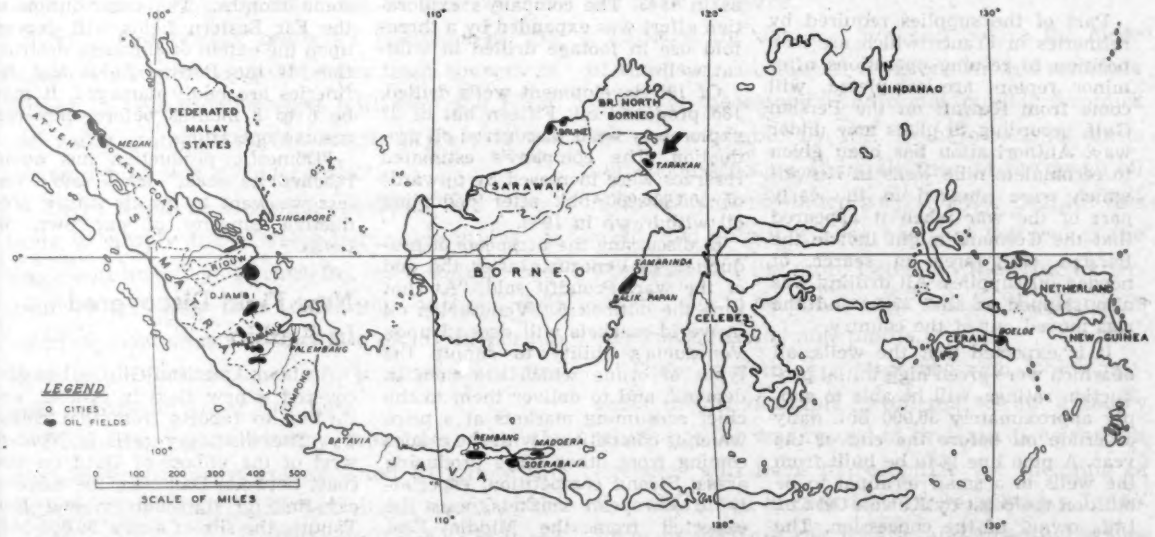
Tarakan crude is of the heavy nonwaxy type. Its high flash point (100° C.), low viscosity and pour point, and low coking value make it an excellent liquid fuel. It usually is sold for that use as it comes from the ground, without need of distillation. Its chemical composition corresponds to the nonwaxy Balikpapan crude, but its aromatic content is about 32 per cent lower. Its naphthene content is that much higher. In Tarakan a waxy crude has also been found at greater depth, but it did not figure in prewar production.

The Balikpapan crude contains about 8 per cent of paraffin wax, which makes its topped residue preeminently suitable for manufacture of paraffin wax. The Miri crudes are of a special character. The upper strata yield a reddish-brown nonwaxy crude, which is distinctively naphthenic and free from asphalt and wax. The kerosene fraction usually burns less well than equivalent fractions from other oils. It has a pronounced tendency to smoke.

Oil wells on the eastern coast of Borneo and on the island of Java are deep, and if the Japanese have plugged them, some time will be required to get them into operation. Those along the western coast of Borneo are relatively shallow and could be reopened soon. Experts say that wells in Sumatra may be the first to be producing oil in quantity again.

Borneo's largest refinery is at Balikpapan, on the southeast coast. Most of the oil installations were demolished before the Japanese occupied the island in January 1942, but it is believed many of them have been restored.

Burma's daily crude production in 1943 and 1944 is estimated at 2,500 bbl. Daily production of the entire Netherlands East Indies in 1944 is placed at 130,000 bbl. With their crude supplies shrinking, the Japanese are reported to be using the castor bean as a substitute, declaring, too, they have developed a gas for use in place of oil for operation of 100,000 wooden ships now idle.



Tarakan Island, indicated by black arrow, was virtually secured this week by Allied liberating forces. This operation is the first direct move by the Allies to retake the oil-rich East Indies, control of which would substantially diminish the petroleum-supply problem for Pacific forces and deny this all-important military resource to the Japs

INTERNATIONAL

E. J. Mundy, Jr., Elected Secretary of Creole

E. J. Mundy, Jr., was elected secretary and assistant treasurer of the Creole Petroleum Corp. by the board of directors last week. He succeeds W. S. Sollenberger who resigned to accept an appointment in the producing department of Standard Oil Co. (New Jersey).

E. J. MUNDY, JR.

Mundy has been associated with the petroleum industry for 25 years. He joined Creole, largest operator in Venezuela, on July 1, 1944, as statistician and budget analyst. He has been secretary of the producing subcommittee of the Caribbean Area Petroleum Committee of the Petroleum Administration for War since early in 1943.

Sollenberger joined the Jersey company interests in 1926 in Mexico City where he was employed by the Cia. Transcontinental de Petroleo, S. A. Subsequently he became vice president of the Huasteca Petroleum Co. He remained in Mexico until elected secretary of Creole on July 1, 1944.

Kuwait to Furnish Oil To French Refineries

Part of the supplies required by refineries in France which are in a position to resume operations after minor repairs are completed, will come from Kuwait on the Persian Gulf, according to plans now under way. Authorization has been given to recomplete nine wells in Kuwait which were plugged in the early part of the war when it appeared that the Germans might invade the Persian Gulf area in search of needed oil supplies. All drilling was also stopped at that time and the rigs moved out of the country.

It is expected that the wells, all of which were given high initial production ratings, will be able to supply approximately 30,000 bbl. daily of crude oil before the end of the year. A pipe line is to be built from the wells to a small terminal to be built on the coast by Kuwait Oil Co., Ltd., owner of the concession. The company is jointly owned by Gulf Oil Corp. and Anglo-Iranian Oil Co., Ltd. Plans for a much larger development of the concession in Kuwait which is credited with proven reserves at this time of approximately 5 billion barrels, are now under consideration.

It is also understood that should transportation be available later in the year the French refineries will be furnished supplies from the Arabian fields of Arabian American Oil Co. The company will have production in excess of the 50,000-bbl. daily requirements of the new refinery being built at Ras Tanura in Arabia and the additional capacity of the refinery on Bahrein Island which is being supplied with Arabian crude oil.

The first Kuwait crude oil will go to four refineries located on the Mediterranean coast in France. These plants came through the war with little or no damage. Other plants in the Paris area are to be rehabilitated as quickly as possible.

Creole's Production Increased 44 Per Cent

In response to war demand, Creole Petroleum Corp. produced 44 per cent more crude oil in Venezuela in 1944 than in 1943, according to the annual report of Arthur T. Proudfit, president, to the shareholders. Daily net production, plus purchased royalty oil, averaged 372,642 bbl. a day. Total production was 136,386,997 bbl.

To obtain the required increase in production, Creole drilled three times as many development wells as in 1943. The company's exploration effort was expanded by a threefold use in footage drilled in wildcat wells.

Of 196 development wells drilled, 185 produced oil. Fifteen out of 27 exploratory wells discovered oil production. The company's estimated reserves were increased by upwards of 500,000,000 bbl. after deducting oil withdrawn in 1944.

In discussing the prospects of production in Venezuela after the end of the war, Proudfit said, "At that time the outlook for Venezuelan oil in world markets will depend upon Venezuela's ability to supply the types of crude which are then in demand, and to deliver them to the chief consuming markets at a price which is competitive with the crudes coming from other large producing areas. Strong competition, especially in European markets, must be expected from the Middle East where production has been substantially increased under the stimulation of war."

He added that Venezuela "is in a more favorable competitive situation than at any time in the past," pointing out that Venezuela can now supply medium and light crudes as well as the heavy crudes for which it is noted.

Referring to the new refinery which Creole will build in Venezuela, the report stated that the new plant will have a capacity to process at least 40,000 bbl. a day. The cost is estimated at $50,000,000, of which $10,000,000 will be spent for housing, schools, medical and recreational facilities for employes.

During 1944, Creole exported from Venezuela 136,000,000 bbl. of crude oil and products, an increase of 39 per cent over 1943.

The company reported that 93 per cent of its employes are now Venezuelan nationals and that the number of employes had increased from 8,009 in 1943 to 8,794 in 1944.

Foreign Development Necessary for Pacific War

WASHINGTON. — Continued development in foreign oil fields will be necessary to fill the demands for the Pacific War, Petroleum Administrator Harold L. Ickes told his press conference last week.

"The present 5,100,000 bbl. daily domestic production must be supplemented from outside the U. S.; hence it is still necessary to supplement with foreign development," Ickes pointed out.

Ickes mentioned the British Abadan refinery, production in Venezuela and other sections of the Middle East in detailing steps taken already to increase foreign production. Russia is now producing, he said, and Borneo may be back in some months. The contribution of the Far Eastern fields will depend upon the extent of Japanese destruction. If the Borneo fields and refineries are badly damaged, it may be 6 to 8 months before they can resume operations.

"Domestic production has about reached its peak," Ickes said, "unless we want to impair future productive capacity of our own oil fields."

New Field Discovered In Arabia

Arabian American Oil Co. has discovered a new field in Arabia, according to reports from that country. The discovery well is located west of the village of Qatif on the coast between Damman, the discovery field of the country, and Ras Tanura, the site of a new 50,000-bbl. refinery now under construction. No details regarding the size of the discovery have been announced.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Next—A Fuel-Oil War

WASHINGTON.—We are shifting from a "gasoline" war to a "fuel oil" war. The shift, including the transition period, will bring changes in operating procedure, with increases in total petroleum requirements of the United Nations, as soon as the Pacific offensive reaches an all-out status.

Preparation for and progress of the war in Europe placed the greatest emphasis on gasoline. Thousands of airplanes softened the enemy and tens of thousands of gasoline-consuming tanks, trucks and motor vehicles of every conceivable type completed the job. Other petroleum products played their essential parts in bringing victory, but gasoline requirements for land and air forces established the pattern of refinery operations.

Gasoline will continue to play its vital part in strategy looking to a speedy victory on a one-war front, but the heavier products of petroleum will control in determining what can be done by our military. The widely scattered positions of the Japanese and the long distances from sources of supply in both hemispheres will give the Navy and water transportation a foremost place in the remainder of this global conflict.

There must be sufficient residual and diesel fuels to supply these water-borne operations, or there will be delays in carrying out a miltary program which has been definitely outlined and which is now ahead of schedule owing in part to herculean efforts of those who produce and transport petroleum's war products.

Production and refinery schedules over the next several months are expected to follow this pattern: The total liquid petroleum needs of domestic producers and refiners will not be reduced, and may be expanded slightly. Refinery operations outside this country will be at capacity, with emphasis on the refining of low-gravity crude oils, which yield the maximum of heavy products.

All war-product operations based on petroleum will be directed toward the goal of fully supplying the needs of the Pacific area. More of the super grades of aviation gasoline will be manufactured to support the long-distance bombing in the Pacific. This program will result in decreased percentage yields of aviation gasolines, with some increase in the recovery of fractions suitable for civilian gasolines.

These changes in plant processing, plus the lowered military requirements of all-purpose motor fuel, will ease civilian gasoline rationing in this and other countries for a time at least. The reduction of civilian rationing here is estimated as high as 50 per cent. It is made clear that no increased quantities of other petroleum products are to be expected.

Should the Jap war not end before the close of the year, substantial revisions in this schedule might be necessary. Additional outside supplies will be available by fall from processing units under construction. Rehabilitation of European oil facilities will be under way shortly. Despite this additional output it is agreed that the longer the war lasts and the more extended the Allied operations have to be, the greater will be the demands on existing fields and plants.

There is nothing in this program which presents unsurmountable problems to an industry which has the war record of this one. Government agencies will have to recognize the meaning of this additional burden in their regulations. Petroleum moves into the Pacific and the final stages of the war fully prepared to do its part.

T.C.C. Announces Liquid Processing Using Pelleted Clay or Beaded Catalyst

by T. P. Simpson*

THE Thermofor Catalytic Cracking (T.C.C.) process[1,2] represents one of the outstanding major developments in catalytic cracking. After its introduction to the petroleum refining industry shortly after the Pearl Harbor attack by the Japanese in late 1941, the T.C.C. process was quickly accepted by leading refiners as a key process for use in 100-octane aviation gasoline projects for producing high-quality base stocks, isobutane, butylenes, isopentane, pentenes and aromatic hydrocarbons. As a result 34 T.C.C. units have been installed and are now in operation in the United States. These units have a nominal capacity rating of 370,000 bbl. per day charge to the reactors. They are at present being used in processing gas oils, naphthas and catalytic stocks for the production of aviation base stocks and raw materials for alkylate and butadiene manufacture but when the war ends they will undoubtedly be changed to operations for the production of high-octane motor gasoline.

Postwar operation of these units for motor gasoline probably will be largely on gas oil charge stocks having mid boiling points of about 700° to 800° F. and end points below about 1,000° F. which are capable of being charged in vapor phase to reactors along with moderate concentrations of steam. However, a number of refiners will undoubtedly have higher boiling-range charge stocks which cannot be charged by the conventional vapor-phase methods. To meet this demand for processing very high boiling charge stocks the T.C.C. process now offers a new technique whereby liquid charge stocks are converted in the reactor to high yields of high-quality motor gasoline and distillate fuel oils.

*Research and development laboratories, Socony-Vacuum Oil Co., Inc., Paulsboro, N. J.

Pioneered by Socony-Vacuum

The T.C.C. liquid charge technique is a development of the research and development laboratories of Socony-Vacuum Oil Co. at Paulsboro, N. J. This organization pioneered in catalytic cracking research and is responsible for the invention and development of the original T.C.C. process[1,2], the Thermofor kiln[3,4], the synthetic bead catalyst[2], and numerous refinements of the Houdry catalytic cracking process[5]. Licensing of the T.C.C. process and the liquid charge modification thereof will continue to be through Houdry Process Corp. The authorized contractors are E. B. Badger & Sons Co., Betchel-McCone Corp. and The Lummus Co.

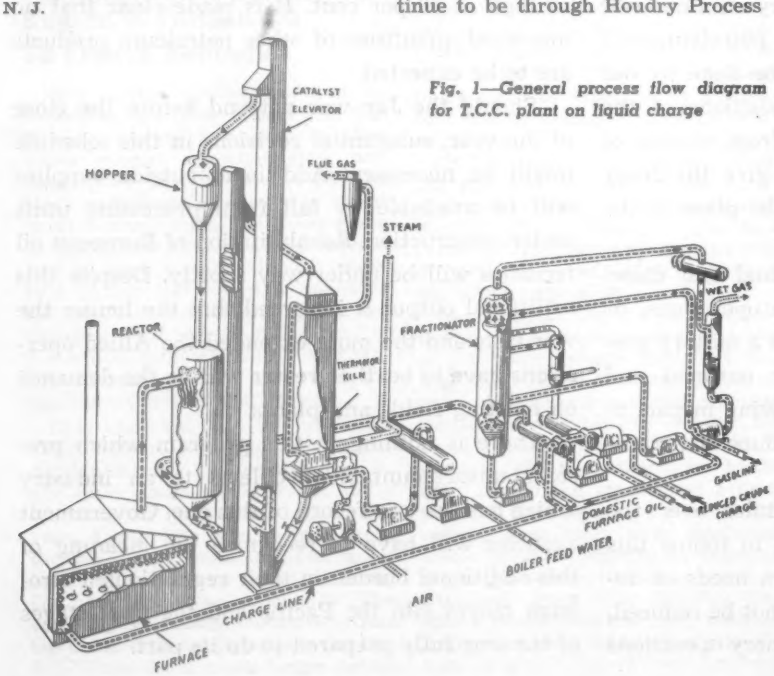


Fig. 1—General process flow diagram for T.C.C. plant on liquid charge

The method of handling the catalyst for liquid-charge-stock operation is the same as for vapor phase. Similarly, either pelleted clay or synthetic-bead catalyst may be employed. Referring to the flow diagram, Fig. 1, catalyst is supplied to the reactor from a hopper located directly above it which continuously receives freshly regenerated catalyst from the Thermofor kiln. From this hopper catalyst flows downward by gravity through an elongated feed pipe and enters a distributing chamber located in the top part of the reactor immediately above the reaction zone. Catalyst flows from the distributing chamber through distributing pipes to the top of the main catalyst bed in the reactor. The reaction zone consists of a solid deep bed of catalyst which provides adequate time for the catalytic reaction to take place. Below the reaction zone a steam purge section is provided to remove oil vapors from the catalyst mass before it is withdrawn from the bottom of the reactor. After steam purging the spent catalyst is withdrawn through a pipe on the bottom of the reactor and is delivered into a bucket elevator which lifts it to the top of the Thermofor kiln regenerator. The spent catalyst gravitates downward through the kiln, where it is freed from carbonaceous deposits by combustion with air under controlled temperature conditions. Air is supplied to the kiln from a low-pressure blower. The excess heat developed in the kiln is converted directly into high-pressure steam. Regenerated catalyst leaving the bottom of the kiln, now having its activity restored to the proper level, is lifted by a second elevator to the top of the reactor side of the unit, and is delivered to the hopper which continuously feeds the reaction system with catalyst, thus completing the catalyst cycle.

The reactor used for liquid charge operation is the concurrent solid bed downflow type. Liquefied charge stock is first preheated in a conventional type furnace to a temperature near the desired catalytic-reaction temperature. It then enters the upper part of the reactor and is uniformly distributed onto the down-

flowing mass of catalyst. The catalyst particles are extremely porous and avidly soak up the liquid oil. Operating temperatures of 800°-950° F. and pressures of 5 to 15 lb. gage are maintained in the reaction zone. About 5 to 10 per cent by weight of steam based on charge is normally fed to the reactor but the use of steam and the amount used are optional. The catalyst-to-oil ratio is also a variable, ratios of 1 to 6 on a weight basis representing the operating range for most cases. The liquified oil gradually reacts with the catalyst under the high temperature conditions prevailing in the reaction zone and the reaction products being of high volatility relative to the charge stock are released from the catalyst particles as vapors and flow out through the voids in the catalyst mass.

Residence Time in Reaction Zone

Catalyst residence time in the reaction zone is, of course, one of the variables, with practical operations falling in the range of a few minutes to 2 hours. Space velocity—the ratio of volume of liquid oil charged per hour to the apparent volume of catalyst mass in the reaction zone—is likewise a variable, the operating range being from about 0.2 to 3. By providing adequate soaking time in the reaction zone the liquid charge stock reacts completely and is converted into gasoline, cycle stock, gas and coke. The vaporous reaction products are separated from the catalyst mass in a collector duct system near the bottom of the reactor and are then conducted to a fractionating system for separation into finished products. The spent catalyst from the reaction zone, which contains a nonvolatile carbonaceous deposit, is then purged with superheated steam to free it from entrained vapors before removing it from the reactor for transfer to the catalyst regenerator. The mixed purge vapor passes up through the catalyst mass until it reaches the collector duct system and then exits along with the main vapor steam.

The reactor charge may consist of liquid alone or part liquid and vapor. This makes possible a high degree of flexibility in adapting the process to refinery operation on all types of charge stocks. Typical heavy charge stocks of low volatility are listed in Table 1. Representative yields of motor gasoline, light fuel oil and heavy cycle stock for liquid charge T.C.C. operations on these stocks are given in Table 2.

Many other stocks have been processed successfully by the liquid-charge technique. One curious stock tested was a 7.8° A.P.I. gravity Duo-Sol tar which yielded 28 per cent motor gasoline, 17 per cent light fuel oil and 25 per cent of heavy cycle stock. Operations on such stocks are interesting but are not considered attractive because of the excessive coke formation encountered, and these striking results are mentioned simply to demonstrate the ability of the process to handle the heaviest types of charge stocks.

TABLE 1—PROPERTIES OF TYPICAL LIQUID CHARGE STOCKS

	Deasphalted 15 per cent E. Tex. residuum	25 per cent Mid-Continent residuum	Kansas crude vacuum distillate
Gravity, °A.P.I.	23.2	21.2	22.3
Pour point, °F.	>125	85	110
Distillation, °F. (vacuum assay)			
Initial	817	693	748
5 per cent volume	933	792	792
10 per cent volume	961	840	835
20 per cent volume	992	900	861
30 per cent volume	1,009	944	880
40 per cent volume	1,032	973	912
50 per cent volume	1,060	1,006	950
60 per cent volume	1,106	1,013	980
70 per cent volume	....	....	1,025
80 per cent volume	....	....	1,075
90 per cent volume	....	....	1,150
E. P.	....	....	†1,250

†Estimated.

TABLE 2—TYPICAL T.C.C. YIELDS WITH LIQUID CHARGE STOCKS

Yields on charge—	Deasphalted 15% E. Tex. residuum	25% Mid-Continent residuum	Kansas crude vacuum distillate
10-lb. 410 °F. E.P. motor gasoline	55.9	47.6	52.4
Light fuel oil (630 °F. E. P.)	19.4	16.3	18.1
Heavy cycle oil	12.7	21.5	17.2
Excess C_4	9.6	7.8	7.5
Total C_4 + liquid recovery	97.6	93.2	94.2

The properties of catalytic products made from T.C.C. cracking of heavy liquid charge stocks are normal in all respects. Motor gasolines have excellent volatility with octane ratings of 77 to 82 C.F.R.M. and 87 to 95 C.F.R.R. unleaded. Light fuel oil distillates (630° F. e.p.) made from waxy high pour point charge stocks are below 0° F. pour point, usually in the range of —10 to —30° F. Heavy cycle stocks made from charge stocks boiling predominantly above 900° F. have mid boiling points in the range of 700° to 800° F. and 90 per cent points about 900° F. Table 3 gives the properties of light fuel oils and heavy cycle stocks.

Coke deposits for heavy liquid charge operations are normal considering the nature of the charge stocks. Generally speaking coke deposition from such heavy stocks is two to three times greater than from medium boiling range gas oils from similar crude sources.

Cracking of asphalt bearing residuum is of questionable merit. Thus it may be better economy to deas-

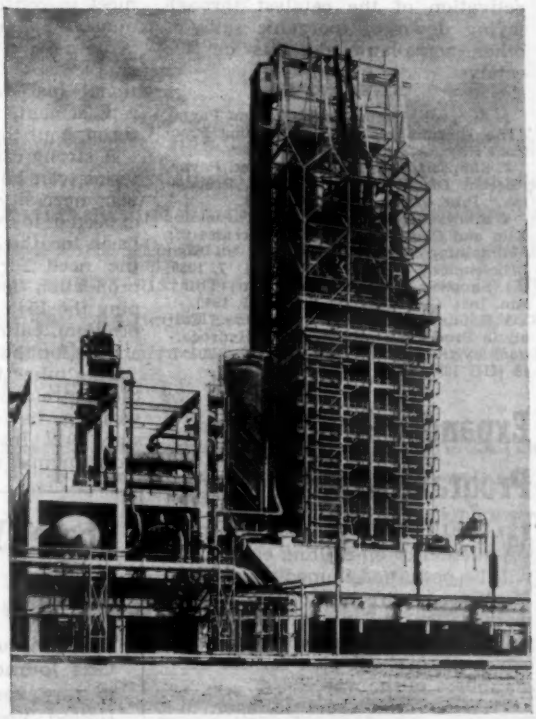


Fig. 2—The first two commercial Thermofor catalytic cracking units placed on stream at the Beaumont refinery of Magnolia Petroleum Co. on October 11, 1943. During the last 6 months of 1944, these units operated with the stream-time efficiency of 96.2 per cent with an average charge to reactors of 20,550 bbl. per stream day

TABLE 3—PROPERTIES OF LIGHT FUEL OILS AND HEAVY CYCLE STOCK FROM LIQUID CHARGE STOCKS

	Deasphalted 15% E. Tex. residuum		25 per cent Mid-Continent residuum		Kansas crude vacuum distillate	
T.C.C. charge stock type—	Light fuel‡	Heavy cycle	Light fuel‡	Heavy cycle	Light fuel‡	Heavy cycle
Gravity, °A.P.I.	26.9	14.5	26.4	18.5	25.0	18.2
Pour point, °F.	<—35	85	<—35	80	<—35	85
Type distillation—	ASTM	ASTM	ASTM	Vacuum assay	ASTM	Vacuum assay
Initial, °F.	432	622	450	669	445	670
5 per cent volume	462	652	476	694	464	713
10 per cent volume	468	668	482	710	472	721
20 per cent volume	477	684	490	723	484	733
30 per cent volume	486	694	501	740	495	748
40 per cent volume	499	702	510	767	506	757
50 per cent volume	512	712	520	796	520	772
60 per cent volume	531	724	532	823	534	787
70 per cent volume	543	734	548	853	552	805
80 per cent volume	564	748	568	890	572	829
90 per cent volume	587	...	588	940	592	880
End point	612	...	618	...	622	...
Rec., per cent volume	99	...	99	...	99	...

‡Light fuel oils cut above 10-lb. R.v.p. motor gasolines of about 390° F. e.p. and 356° F. at the 90 per cent point.

phalt the charge stock by vacuum distillation or other conventional methods prior to charging it to the catalytic unit. The ultimate selection of the type of stock, whether deasphalted or not, thus becomes a matter of economics which must be decided on the basis of investment and operating costs for the catalytic unit. In any event when a nonrefined residuum is charged, provision for desalting of the charge stock must be made to prevent abnormal deactivation of the catalyst through laying down of inorganic salts or other nonvolatile deposits on the catalyst.

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Expanded Drilling Program Assured

WASHINGTON. — Additional production of oil-drilling equipment will be permitted immediately, Fred M. Vinson, director, office of war mobilization and reconversion, said this week in announcing the Government's over-all plan for the second phase of the war.

PAW is understood to have already presented the industry's third quarter claim to the War Production Board's requirements committee. It can be expected that a large claim for supplemental materials for badly needed replacement, repair and expansion throughout the industry will be made by PAW. Second quarter allocations to the petroleum industry totaled 511,500 tons on carbon and alloy steel.

While officials cannot now predict the post V-E Day materials situation, the picture for the oil industry appears very good.

PAW is now expected to present the industry's requirements to War Production Board's Requirements Committee at its meeting on May 16. Officially, this group will meet to consider the regular third-quarter materials allotments, but it is now expected that these will be supplemented by claims for additional materials for badly needed replacement, repair, and expansion throughout the industry.

A strong case for oil-industry materials can be made on the basis of war necessity. Crude-oil output is expected to continue on an all-out basis for the war with Japan, and the need for maintaining present production levels may justify upping the 1945 drilling program. This program, calling for 27,000 wells, is a high for the war period.

Like other top-priority industries, the petroleum industry has been wearing its equipment very thin since 1942. Inadequate storage space, worn pumps, refinery equipment in need of replacement, and many other acute needs can be cited as ample reason for increasing materials supplies as quickly as they are released by the military. Refineries, operating well over capacity rating, are particularly in need for rehabilitation.

The steel industry has already assured WPB that it can take care of military requirements for the war against Japan and at the same time provide steel for war-supporting civilian activities and for reconversion. Since the petroleum industry has been assured of high priority for expansion and replacement to fill military needs, it can be expected that PAW's claims over and above the tight third-quarter requirements will be considered favorably.

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DEATHS

R. E. Diggins, California oil man who for 30 years has been identified with Standard Oil Co. of California, Union Oil Co. and Barnsdall Oil Co., died last week at his home in Los Angeles.

Edgar Wayne Galliher, 38, chief geologist of Barnsdall Oil Co., died at his home in Los Angeles last week from a gunshot wound accidentally inflicted. Galliher was president of the Pacific section, American Association of Petroleum Geologists, in 1941.

Henry O. Loebell, 59, widely known technologist and consultant in the gas, petroleum and electrical industries, died May 3 in Rye, N. Y. Loebell, who in 1934 received the Charles A. Munroe Award for distinguished contributions to the gas industry, was vice president and general manager of Combustion Utilities Corp, devoted to research in production and utilization of natural and manufactured gas.

James P. Strickler, 76, superintendent of distribution for Ohio Fuel Gas Co. until his retirement in 1930, died last week in Columbus, Ohio. He was in the company's service 42 years.

Samuel Felix Johnson, 62, former superintendent of Constantin Refining Co., Tulsa, died last week in Cheyenne, Wyo. Johnson was formerly employed by Prairie Oil & Gas Co., and Mid-Continent Petroleum Corp. He had lived in Cheyenne for several years.

Arthur J. Stewart, 40, oil operator of Owensboro, Ky., died April 23. Besides his connection with Stewart & Snyder Oil Co. he was associated with Thomas Galey and Frank Zogg in various oil interests.

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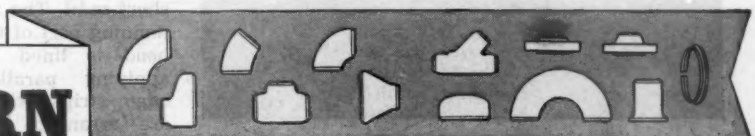


THE COMPLETE LINE OF WELDING FITTINGS AND FLANGES

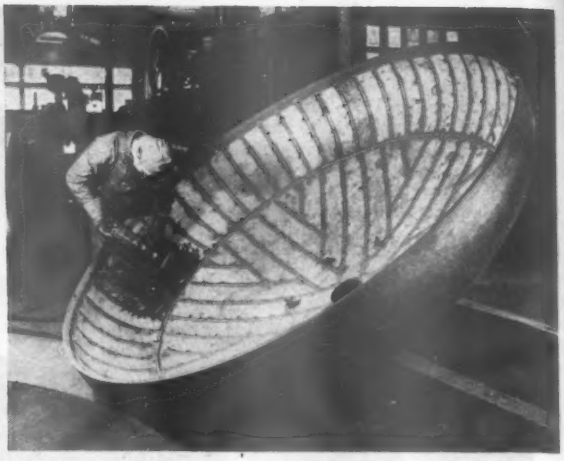


Fig. 1—(Left) Head lining for cracking-unit bubble tower as carried out in field by T. & R. Construction Co. Fig. 2—(Right) Shop lining job by Wyatt Metal & Boiler Works

Method for Field Lining Vessel Heads With Stainless Steel Strip

by K. E. Luger*

The method described here for protecting refinery-vessel heads against corrosion has the virtue of economy and simplicity, requiring no elaborate detailing in the drafting room. Expense of shop fabrication may be eliminated, and field fitup time usually is lowered because the small pieces allow flexibility. Also, waste from scrap is negligible.

IT is generally recognized that the currently best method for protecting refinery vessels against high-temperature corrosion is with stainless steel sheet or strip linings. A detailed description of a simple method for fitting and attaching stainless steel liners to heads apparently has not been included in any of the published articles. A method for lining heads is described herein.

In this method the straight flange of the head is considered as a part of the vessel's side wall, the short curved areas of the knuckle radius are lined with a series of short-length and narrow-width strips which are combined with wedge-shaped pieces so as to extend the side-wall lining to a point beyond that of the intersection of the head's long and short radii. The remaining part of the head is lined by applying parallel-edge strips which are arranged into a herringbone pattern as illustrated by the accompanying photographs. Fig. 1 illustrates clearly the position in which the strips are placed to form the herringbone pattern; Fig. 2 shows a variation of pattern in the herringbone arrangement, but the lining at the straight flange and knuckle, as shown in Fig. 2, is not illustrative of the method described here for that part of the head. Another view of the herringbone pattern is illustrated in Fig. 3 as is the method for lining the knuckle radius area.

Important among the advantages of this method of lining heads is that of simplicity. No elaborate detailing is required in the drafting room; often the total man hours required to install the lining does not exceed those taken up in drafting-room layout time where some other method is used. Expense of shop fabrication may be eliminated and field fitup time usually is lowered because the small pieces allow fitup flexibility. The tendency for the welders to lap or "shingle" the pieces runs to a minimum. Waste from scrap is negligible and the same stock used for lining the vessel side walls is used for lining the heads, thereby eliminating segments of circles and large rectangular pieces usually required by other methods.

To line a head by this method, about all that is required in the way

*K. E. Luger Co., Houston.

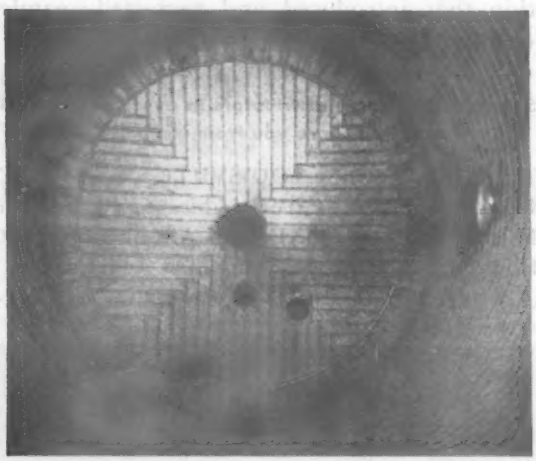


Fig. 3—Head and sidewall lining done in field by T. & R. Construction Co.

of engineering is a print to scale of the tower which shows the approximate dimensions of the head. For the cutting of the strips and wedges a portable throatless-type shear is desirable. The shear should be suitable for cutting 14-gage (0.078-in.) stainless steel; one which will handle ⅛ to $\frac{3}{16}$-in. ordinary carbon-steel plates will serve.

From a dimension print of the head, the approximate dimensions of the wedge-shaped pieces and the lengths of the parallel-edge pieces for lining the knuckle radius area may be determined. It is generally

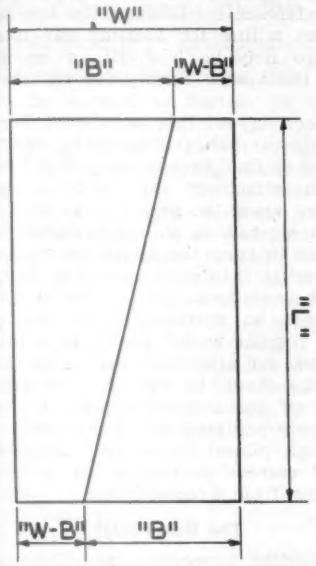


Fig. 4—Dimensions of wedge pieces for lining towers

found that one parallel or full-width strip and one wedge-shaped piece, alternately placed, will make a satisfactory arrangement for medium-diameter heads. For very large-diameter heads the arrangement of of one wedge piece to two full-width strips may make an easier fitup job. In the cases of very small-diameter heads simpler fitup results when two wedges are used with one full-width strip. In all cases lapping of adjacent strips is avoided by using the wedge-cut pieces of the proper shape.

Wedge pieces are cut from parallel edge strips as illustrated in Fig. 4. The step-by-step procedure for determining all of the necessary dimensions for cutting the wedges is given in the following:

D: Inside diameter of the head, is obtained from the dimension drawing of the head.

L: Length of the wedges and of the full-width strips is arbitrarily set so as to allow the strips to extend from the tangent of the head's straight flange on the knuckle radius to 2 or 3 in. beyond the intersection point of the knuckle and dish radii, but not exceeding a total of 12 in. The usual lengths run between 8 and 10 in., which allows a reasonable amount of flexibility in fitting the pieces around the curved section of the head.

D_1: Diameter on the head at a point where the strips end (Fig. 5).

W: The width of the strip which usually is the same as that of the stock used for lining the vessel walls. (Conditions of operation, mainly that of temperature, are the determining factors in selecting strip widths for vessel wall linings.)

B: Larger of the two end dimensions of the wedge piece. Having been cut from stock of "W" width the dimension of the smaller end of the wedge is "W — B."

J: Width of the weld bead between adjacent strips or wedges. For each strip or wedge there is a welded seam which runs about ¼ in. in width as an average, hence in determining the wedge dimensions the value of "J" will be used at ¼ in.

N: Number of full-width strips and wedges required.

Where it is desired to use a wedge-shaped piece alternately with a full-width strip the value of "B" is determined as follows:

$$\pi D = N\,[(W + J) + (B + J)]$$

$$\pi D_1 = N\,\{(W+J) + [(W-B) + J]\}$$

From above:

$$N = \frac{\pi D}{W + 2J + B} = \frac{\pi D_1}{2W + 2J - B}$$

Therefore:

$$B = \frac{(2W + 2J)\,D - (W + 2J)\,D_1}{D_1 + D}$$

and where $J = \frac{1}{4}$,

$$B = \frac{(2W + \frac{1}{2})\,D - (W + \frac{1}{2})\,D_1}{D_1 + D}$$

Where one wedge piece is to be used with two full-width strips "B_1" is determined by the following:

$$\pi D = N_1\,[(2W + 2J) + (B_1 + J)]$$

$$\pi D_1 = N_1\,\{(2W+2J) + [(W-B_1) + J]\}$$

From above:

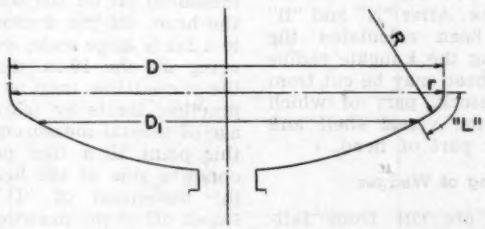
$$N_1 = \frac{\pi D}{2W + 3J + B_1} = \frac{\pi D_1}{3W + 3J - B_1}$$

Therefore:

$$B_1 = \frac{(3W + 3J)\,D - (2W + 3J)\,D_1}{D_1 + D}$$

and where $J = \frac{1}{4}$,

$$B_1 = \frac{(3W + \frac{3}{4})\,D - (2W + \frac{3}{4})\,D_1}{D_1 + D}$$



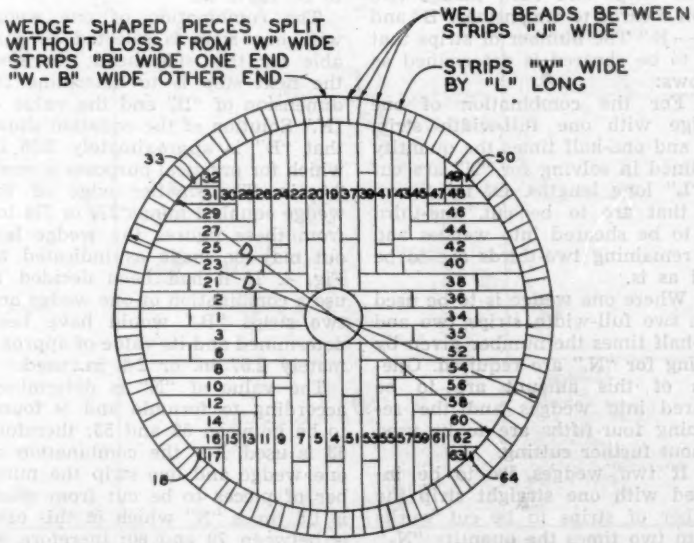

WEDGE SHAPED PIECES SPLIT WITHOUT LOSS FROM "W" WIDE STRIPS "B" WIDE ONE END "W - B" WIDE OTHER END
WELD BEADS BETWEEN STRIPS "J" WIDE
STRIPS "W" WIDE BY "L" LONG
33
50
64
18

Fig. 5—Sequence for welding the strips in the herringbone pattern

If it is desirable to use two wedges with one full-width strip the following is used to determine "B_2" values:

$$\pi D = N_2 [(W + J) + 2 (B_2 + J)]$$

$$\pi D_1 = N_2 \{ (W+J) + 2 [(W+B_2)+J] \}$$

From above:

$$N_2 = \frac{\pi D}{W + 3J + 2B_2} = \frac{\pi D_1}{3W + 3J - 2B_2}$$

Therefore:

$$B_2 = \frac{(3W + 3J) D - (W + 3J) D_1}{2 (D_1 + D)};$$

if $J = \frac{1}{4}$,

$$B_2 = \frac{(3W + \frac{3}{4}) D - (W + \frac{3}{4}) D_1}{2 (D_1 + D)}$$

With "W" and "D" known and "L" established at some convenient figure between 6 and 12 in., then D_1 can be determined from these values by laying out the head to scale and measuring the diameter at the points where the scaled distance for "L" falls. Knowing D, D_1, W and J the dimensions of "B," or "B_2" may be easily determined.

The quantity of full-width and wedge pieces may be determined by solving the applicable equation for the value of "N," "N_1," or "N_2" as the case may be. After "N" and "B" values have been calculated the strips for lining the knuckle radius section of the head may be cut from the on-hand stock, part of which is for lining the vessel shell and the remaining part of head.

Cutting of Wedges

All wedges are cut from full-width strips and each makes two when sheared to dimensions "B" and "W — B." The number of strips that are to be sheared is determined as follows:

1. For the combination of one wedge with one full-width strip, one and one-half times the quantity obtained in solving for "N" are cut to "L" long lengths. Of this number that are to be cut, one-third are to be sheared into wedges and the remaining two-thirds are to be used as is.

2. Where one wedge is to be used with two full-width strips two and one-half times the number given by solving for "N_1" are required. One-fifth of this amount are to be sheared into wedges and the remaining four-fifths are to be used without further cutting.

3. If two wedges are to be installed with one straight strip the number of strips to be cut works out to two times the quantity "N_2." One-half of this amount are cut into wedges; the balance remains as full-width strips.

The figures obtained by solving for "N," "N_1," and "N_2" often are in fractional amounts where in such cases the next whole amount is to be used. For example, if "N_1" = 64.8, use 65. Likewise, in calculating the number of strips that are to be cut to length and also the quantity that are cut into wedges the next whole number above that obtained by calculation is to be used as the amount required.

Illustration of Method

How this method is used is illustrated in the following:

From the dimension drawing of an A.P.I.-A.S.M.E. code flanged and dished head the i.d. = 114 in., the knuckle radius = 6⅞ in., dish radius = 108 in. and the straight flange 4 in., as shown in Fig. 5. Lining strips 4 in. by 30 in. which are to be used for lining the side walls of the vessels also are to be used for lining the head. From the scale layout of the head it is found that a convenient length for the knuckle radius lining strips works out at 10 in. which is nearly 2¾ in. longer than the arc length formed by the knuckle radius and therefore extends beyond the intersection point of the knuckle and dish radii.

Beginning at the intersection of the straight flange and the knuckle radius the strip length of 10 in. is measured off on the scale layout of the head. (If the drawing layout is to a fairly large scale, error in measuring off the 10-in. distance along the curved line may be held within practical limits by taking an average of several measurements.) From this point to a like point on the opposite side of the head layout is the dimension of "D_1" which is scaled off of the drawing and found to be 102½ in.

The combination of one wedge with one strip is selected as suitable for this side head; therefore the next step is to determine the dimension of "B" and the value of "N." Solution of the equation shows that "B" is approximately 2.36 in. which for practical purposes is made 2⅜ in. The smaller edge of the wedge equals 4 minus 2⅜ or 1⅝ in.; from these figures the wedge layout may be made as indicated by Fig. 4. If it had been decided to use a combination of one wedge and two strips "B_1" would have been determined and its value of approximately 2.57 in. or 2⅝ in. used.

The value of "N" is determined according to formula and is found to be between 52 and 53; therefore 53 is used. For the combination of one wedge and one strip the number of pieces to be cut from stock is 1.5 times "N" which in this case is between 79 and 80; therefore 80 is used. The number of pieces that are to be cut into wedges is one-third of 80, or 27, which is the nearest whole figure. The remaining 53 pieces are used without further cutting. (For "N_1" values and for determining the number of wedges and straight pieces needed applicable formulas would be employed.)

Location of the tangent point at the intersection of the straight flange and knuckle radius, for all practical purposes, may be obtained from the dimension drawing of the vessel. On all properly dimensioned drawings this point is tied into the weld seam that attaches the head to the shell. With the weld seam as a reference for locating the tangent point a line for locating the liner strips may be laid out as desired on the vessel. Lining for the shell may be started or stopped at the chosen layout line as desired. Normally it makes little difference if head or shell lining is installed first.

In attaching the wedges and strips along the area formed by the knuckle radius, an effort should be made to keep the long seams nearly radial. If in some cases it is found that deviations from a radial line cannot be corrected with one of the regular wedge pieces as a substitute for a straight strip, a special wedge should be made by trimming one of the regular wedges to the necessary dimensions. Frequently, a wedge, placed in reversed position, will correct deviations, in welded seams, from a radial line.

The Basic Rule

Welding procedure for attaching liners to the head is the same as that followed in applying liners to the shell section. The basic rule is that all edges of each strip or piece must be directly and securely welded to the head—the pieces must not be allowed to overlap.

Sequence for welding the strips in the herringbone pattern is outlined in Fig. 5. It should be noted that these pieces are used with parallel sides, that is, as received from the mill. Generally, each succeeding strip is placed at right angles to the strip, which previously has been welded completely. The ends of these pieces only are cut to fit on location. The welder determines how the ends of a particular strip must be cut to fit, mark it with chalk and then either has his helper cut it on a portable shear or melts it off himself with his arc.

Because nearly all heads vary from dimensional exactness and because of other variables such as seam widths this method has been found more practical than most of those in which precise mathematical layouts are used. With a reasonable amount of ingenuity in fit-up, a good job of stainless-steel lining this type of head can be quickly and easily done.

Shell Oil Reestablishes Control in Louisiana's West Lake Verret Field

by E. H. Short, Jr.

The sudden appearance of a water boil at a well, which quickly was followed by similar eruptions in other parts of the swampland field, posed a perplexing problem. This article describes the remedial methods that brought control in the field

THE problem which developed with rather amazing suddenness in the West Lake Verret field is analogous in many respects to a highly imaginary quiz problem designed to provoke thought in a senior petroleum engineering class.

In this field, located in St. Martin Parish approximately 14 miles north of Morgan City, La., the Shell Oil Co., Inc., operates properties which cover an area of about 700 acres. The field is in a wooded swamp in the Atchafalaya basin, and the area is traversed by numerous bayous and canals. Inasmuch as the elevation is only a few feet above mean sea level, the surface is flooded during periods of high water. Operations are conducted, therefore, on the many Shell-dredged canals which branch off from Big Fork Bayou. There are some 30 wells in the West Lake Verret field.

Surface Eruptions

The first indication on an impending operational problem of serious proportions appeared in the form of a water boil at Shell B-1 Norman Breaux in the south end of the field. The intensity of the water agitation increased until it became a geyser and within a comparatively short period of time 34 boils and geysers appeared in various parts of the field. The violence of the eruptions increased, christmas trees at several wells submerged, a well blew out while drilling at 164 ft., and the formation of new geysers, marked by extreme agitation and upheaval of water, created a dangerous hazard to the operational boats and crews. This chaotic condition was tersely summarized recently by Henry Lay, Shell superintendent in that area, who remarked that "all hell seemed to have broken loose."

The first evidence of gas bubbling through the canal water near B-1 Norman Breaux (Fig. 1) was of such a small nature that it could have been swamp gas. As the intensity of the boil increased it was obvious that swamp gas was not responsible.

At this time there was an occurrence which cast a shadow of the events which were to follow. Nos. B-1 and 2 Norman Breaux began to show analogous flow characteristics and production rather sharply changed from oil to gas simultaneously in both wells. At the same time, water appeared in No. 1, but not in No. 2, although both wells were completed at the same depth. The tubing pressure in both wells increased with the increase in gas production, although there was a distinct decline in the casing pressure at No. 1. This well was not equipped with a packer on the tub-

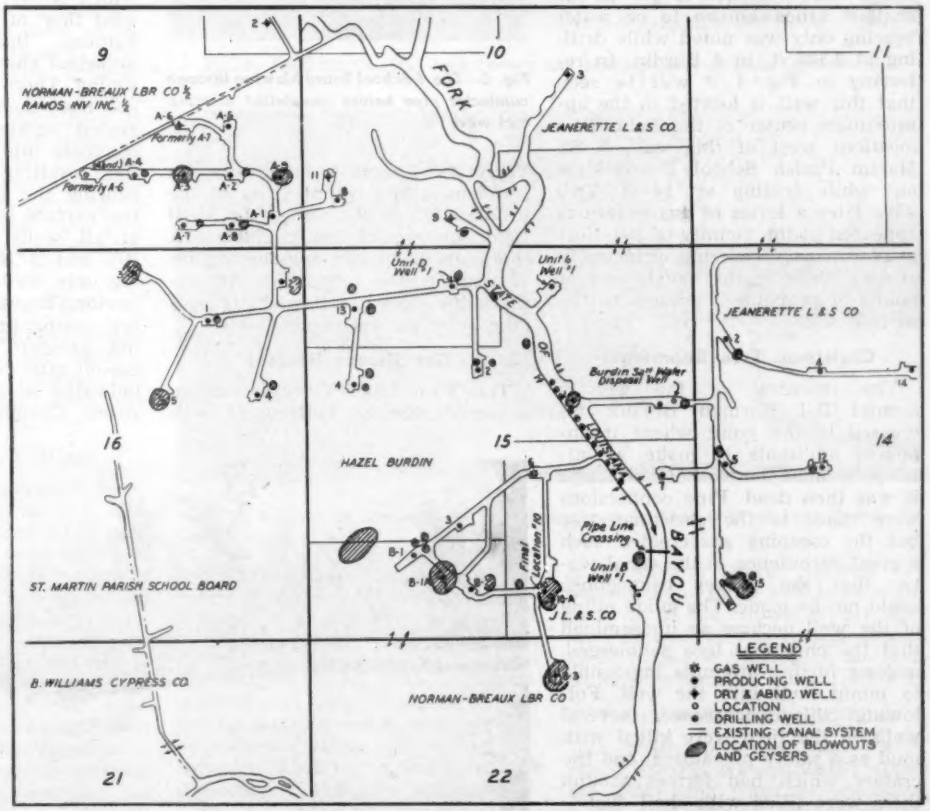


Fig. 1—Shell Oil Co., Inc., West Lake Verret producing area, St. Martin Parish, Louisiana

Fig. 2—Operational canal, dredged by Shell, in West Lake Verret field

ing, whereas No. 2 did have a packer.

These changes in production occurred despite the fact that the highest perforations were 25 ft. below the gas-oil contact, and the lowest perforations 25 ft. above the water level. These wells had both been completed in a sand designated as the NN sand, at practically the same depth of approximately 11,500 ft.

The first rather definite evidence that the escape of gas into the canal water might be from B-1 Norman Breaux was when it was noted that there was gas in the annulus between the 5½-in. oil string and surface casing. The pressure between these two strings amounted to 500 psi. and could not be bled to a pressure lower than 400 psi.

The first evidence of gas in the shallow sands known to be water bearing only was noted while drilling at 2,386 ft. in 4 Burdin. In referring to Fig. 1 it will be seen that this well is located in the approximate center of the field. Two locations west of this well, 5 St. Martin Parish School Board blew out while drilling at 164 ft. Two days later a series of gas eruptions appeared in the vicinity of B-1 Norman Breaux, occurring principally around wells in the canals and at points of probable weakness in the surface soil.

Christmas Tree Submerges

The intensity of the geysers around B-1 Norman Breaux increased to the point where it appeared advisable to make an attempt to mud the well off, although it was then dead. Pipe connections were made to the christmas tree but the escaping gas created such a great turbulence in the canal water that the proper connections could not be made. The guide piling of the well became so undermined that the christmas tree submerged, making further attempts impossible to pump mud into the well. Following this occurrence, several wells in the field were killed with mud as a safety precaution, and the craters which had former around them were filled with shell dust.

This brief summary of the events which occurred in the West Lake Verret field serve to emphasize the seriousness and complexities of the problem which confronted the Shell field supervisors and engineers. A thorough diagnostic engineering investigation was conducted with remarkable speed, followed by specific remedial recommendations.

Fig. 3—The 5 School Board blowing through conductor pipe before completion of remedial work

Gas Escape Sources

The West Lake Verret structure is complicated by faulting of both major and minor proportions. While the major fault appears to traverse the whole section, there are numerous minor faults with small displacements, which are not so well defined. The surface and shallow layers in the field consist of approximately 120 ft. of soft incompetent clays and silts, underlain by a blanket-like layer of sand and gravel approximately 700 ft. in thickness. Extending from the base of the gravel to an approximate depth of 5,000 ft. there is a series of interbedded sands and shales. The beds encountered below 5,000 ft. are primarily sand with streaks of shale. Oil and gas accumulations have been discovered at depths from 1,000 to 11,500 ft.

In considering the remedial work which should be done to stem the wild flow of gas in the upper formations, the problem was approached along several lines of reasoning. There was a possibility that gas from some deep sand had migrated upward through unknown channels into the shallower sands, the resulting pressures evidently causing the gas to break through the surface soil. However, a study of all wells in the field showed B-1 and 2 Norman Breaux to be the only wells having unusual behavior. It was reasoned that the low casing pressure and high tubing pressure, together with high gas-oil ratio in B-1 Norman Breaux indicated a leak in the 5½-in. oil string. Chronological intensities of

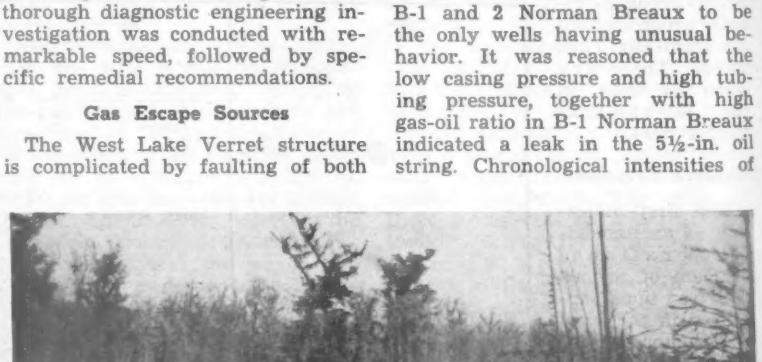


Fig. 4—Water boil at B-1 Norman Breaux

gas eruptions also suggested this to be the offending well.

Relief Well Directionally Drilled

With the source of trouble narrowed down to this well it was decided to drill a relief well in an attempt to stop the flow of gas by pumping mud or cement into the producing formation, or NN sand, in the vicinity of B-1 Norman Breaux.

The precautionary measures anticipated and followed during the drilling of the directional well are characteristic of the efficient manner the whole situation was handled by the Shell from beginning to end. Before drilling the well, the drilling and production staff attempted to anticipate the very unusual problems which would result from such a project. That the plans for taking all steps necessary to insure success were well laid is shown by the fact that no unusual difficulties or accidents were encountered.

It was first assumed that the pressure in the surface sands would be such that unusually heavy mud would be necessary to eliminate the possibility of a blowout. Another hazard to be expected was that of fire. Accordingly, a battery of four boilers on a barge were kept near the well during the entire drilling. One boiler was fired continuously. It was further anticipated that the casing program would have to be designed to provide blowout preventing equipment before encountering the A sand. About a month after the production difficulties at the Norman Breaux wells, 4 Burdin (see Fig. 1) was spudded. This well encountered an appreciable gas accumulation in the top member of the shallow A sand and then at a depth of 1,997 ft. A blowout also occurred at 2,386 ft.

Heavy Mud Used at Start

Accordingly, a viscous mud weighing 15½ lb. per gallon and containing flakes to control possible loss of circulation was used when the relief well was spudded.

Drilling Unit Left Afloat

Contrary to the Shell's usual practice, the marine drilling unit was allowed to remain afloat until casing for the blowout preventer had been cemented. This was to facilitate removal of equipment in the event the well blew out.

A string of 24-in. conductor pipe was cemented at 79 ft., and below this a 22-in. hole was carried to 1,000 ft. and a string of 16-in. supplementary surface casing was then set and cemented with 950 sacks at 990 ft. The blowout preventing equipment was then installed on the 16-in. surface string, although customarily such equipment is not installed until 10¾-in. surface pipe has been set. After installing the blowout preventer the drilling unit was sunk for normal operations, and drilling resumed to 2,469 ft. where the 10¾-in. casing was set. After drilling out the shoe, the mud weight was reduced to approximately 10 lb. per gallon and drilling continued to 3,422 ft. At this point, the deflection of the hole was checked.

The hole was carried on down to 11,490 ft. without unusual difficulty. A directional survey showed the bottom of the relief well to be within 35 ft. of the bottom of B-1 Norman Breaux. It was then deepened to 10 ft. below the top of the sand which was encountered at 11,510 ft.

Relief Well Casing Protected

In order to protect the 5½-in. casing (which was cemented above the NN sand) against excessive pump pressures, a retrievable ce-

(Continued on page 119)

Fig. 5—Typical illustration of extent of subsidence in water boils after Shell remedial work in the West Lake Verret field

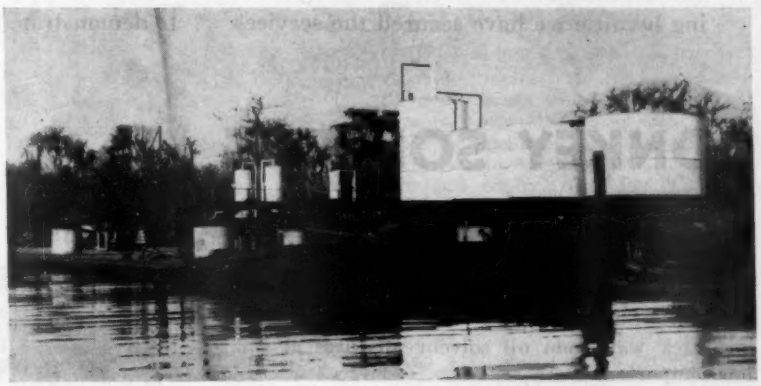


Fig. 6—Shell Oil Co., Inc., tank battery and landing barge in West Lake Verret

Fig. 7—Type of christmas tree installation used by Shell in West Lake Verret

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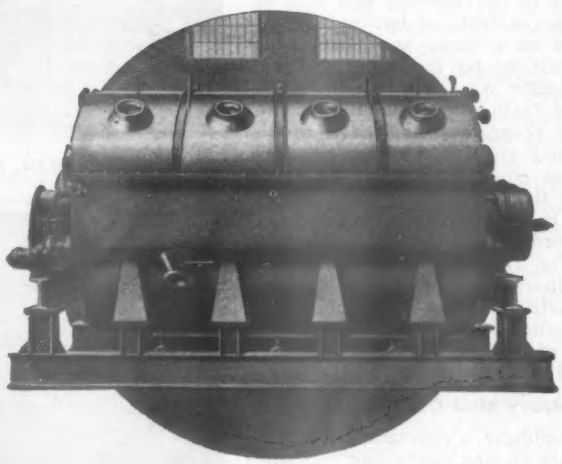

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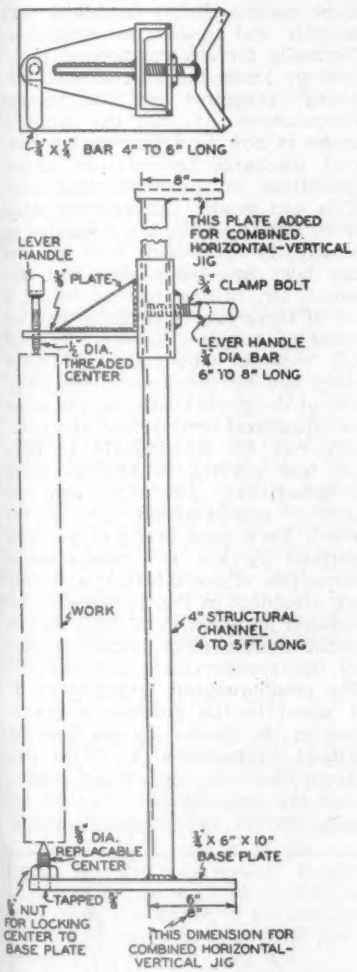
PLANT PRACTICES

Vertical Jig

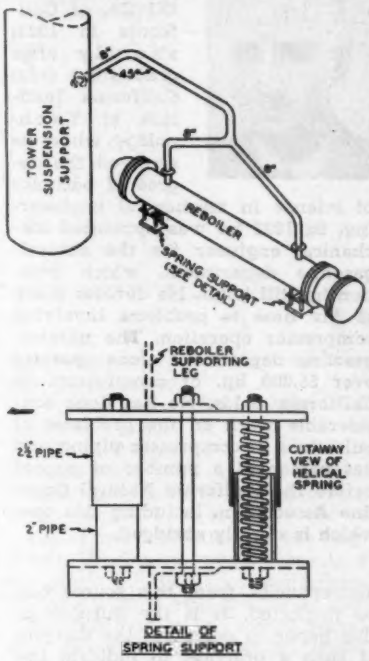
WORN pump rods, shafting and other like shaped items, when requiring repairs by building up the worn areas with weld metal may be conveniently handled in the adjustable jig shown by the accompanying drawing. The jig is arranged for holding the shaft or other part in a vertical work position. If desirable, the jig may be made adaptable to either vertical or horizontal work positions by placing a slate


¼" X ¼" BAR 4" TO 6" LONG
8"
THIS PLATE ADDED FOR COMBINED HORIZONTAL-VERTICAL JIG
LEVER HANDLE
¼" PLATE
¾" CLAMP BOLT
½" DIA. THREADED CENTER
LEVER HANDLE ¾" DIA. BAR 6" TO 8" LONG
WORK
4" STRUCTURAL CHANNEL 4 TO 5 FT. LONG
¾" DIA. REPLACABLE CENTER
¼" X 6" X 10" BASE PLATE
¾" TAPPED
¾" NUT FOR LOCKING CENTER TO BASE PLATE
8"
THIS DIMENSION FOR COMBINED HORIZONTAL-VERTICAL JIG

on the upper end of the 4-in. channel and extending the lower slate to 8 in. as indicated by the drawing. The lever handle of the clamp bolt should be held to around 6 in. in order to be cleared by the 8-in. end plate heights.

Exchanger Spring Support

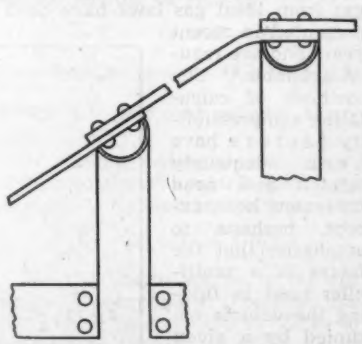
BY installing spring supports to relieve part of the heavy load transmitted to a reboiler by the piping connections from a suspended tower the engineering department made an inexpensive solution of an



otherwise costly job. The specific piping hookup and details of the spring support are shown in the accompanying drawing. For other installations, similar arrangements may be carried out by dimensioning the springs to fit the particular job.

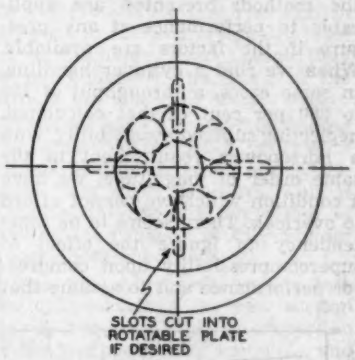
Protection of Rivet Heads

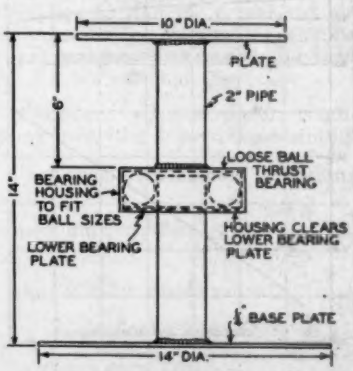
IT was found that rivet heads in the cone bottom of acid agitators were rapidly being corroded out, requiring frequent replacement. To reduce this rate of corrosion the following idea was tried and found efficacious: For a riveted joint with one row of rivets a 4-in. carbon steel pipe is split longitudinally in half, placed in a jog and bent carefully to a segment of a circle the diameter of the circle of rivets, taking care that the pipe half is not flattened appreciably when so bent, with the concave side or inside of the pipe outward. This pipe half is fitted snugly over the row of rivets and is welded in continuous seams to the agitator sheet on each side of the row of rivets. For a double row of rivets a 6-in. pipe is split in the same manner, as shown.



Turntable for Holding Work Under Repair

THE building up, with deposited weld metal, of the faces of flanged fittings and valves, is conveniently handled with the turntable shown in the drawing. Rotated by hand the table allows an operator full control over the work so as to meet his need. Usually the work is held to the rotatable plate with C-clamps along the rim of the disk. Other holddown methods such as are common to the weld shop may be used. The ball-thrust bearing, as illustrated, may be substituted by using a no-longer-serviceable commercial roller or salvaged ball-thrust bearing.





(The ideas described on this page are used in Standard Oil Co. of Ohio's Toledo, Ohio, refinery)

Effect of Supercompressibility of Natural Gas Upon Compressor Performance

by Robert S. Ridgway

THE factors relating to the compression of gases consisting principally of methane at normal pressures have been well established and one has been able to predict the performance of compressors operating under these conditions with good accuracy. When pressures and temperatures are such that deviations from ideal gas laws exist, the effect is known as supercompressibility, and the operation of the compressor cylinder under such conditions must be thoroughly understood in order to predict the volume throughput and horsepower involved.

The effect of supercompressibility is very pronounced at high pressures and even with so-called "dry" gases it may be worth recognizing at suction pressures as low as 200 lb. With "wet" gas mixtures and those which are not principally methane, the effect is usually appreciable at low pressures. This discussion will be confined to performance at high pressures, though the methods presented are applicable to performance at any pressure if the factors are available. When we find a cylinder handling, in some cases, a throughput of 150 to 200 per cent of that calculated, neglecting supercompressibility, with a horsepower requirement in the same order of magnitude, we have a condition which we cannot afford to overlook. There seems to be some tendency to ignore the effect of supercompressibility upon compressor performance and to assume that discrepancies from this source can be neglected. It is the purpose of this paper to point out the dangers of such a practice, to indicate the practical value of the proper treatment, and to present the methods of calculation which recognize this effect. Because this phenomenon is usually most pronounced at relatively high pressures, a discussion of it is very timely as repressuring and cycling operations come to the fore.

The author joined Standard Oil Co. of California in 1925, shortly after graduating from California Institute of Technology, where he received the degree of bachelor of science in mechanical engineering. In 1928 he was appointed mechanical engineer for the natural-gasoline department, which position he still holds. He devotes much of his time to problems involving compressor operation. The natural-gasoline department alone operates over 55,000 hp. of compressors in California fields. He has done considerable work on the problems of pulsations in compressor piping and has presented a number of papers before the California Natural Gasoline Association, including this one, which is slightly abridged.

Compressibility Factors

Excellent papers and curves on the subject of deviation of natural gas from ideal gas laws have been presented in recent years and are readily available.[1,2] The methods of calculating compressibility factors have been adequately treated and need no review here, except, perhaps, to emphasize that the factor is a multiplier used in finding the volume occupied by a given weight of "deviated" gas from the volume occupied by the same weight of gas under ideal gas laws. Curves have been published showing compressibility, or "Z" factors for natural gases as a function of the pseudoreduced pressures and temperatures.[1]

From the gas being compressed it will be necessary to determine these compressibility factors at both suction and discharge conditions. Normally for any compressor problem we know the suction and discharge pressures and the suction temperature. At once the problem arises of how to determine the correct discharge temperature under conditions of supercompressibility. This can readily be approximated from Entropy-Enthalpy diagrams in which the deviation from perfect gas laws has been taken into account. Dr. Brown[3] has published a set of these curves covering natural gases of gravities between 0.6 and 1.0, through wide ranges of pressures and temperature. If the analysis of the gas is available, the exact pseudocritical temperature and pressure can be determined.[1] If only the gas gravity is known, these pseudocritical constants can be closely approximated by curves which have been prepared for this purpose by the gas measurement committee of the C.N.G.A. and they are presented in Fig. 1. The pseudoreduced pressure, P_r is equal to the absolute pressure in pounds divided by the pseudocritical pressure, P_c. The pseudoreduced temperature T_r is equal to the absolute temperature in °R. divided by the pseudocritical temperature, T_c. With this information we can readily determine the compressibility factors for both suction and discharge condi-

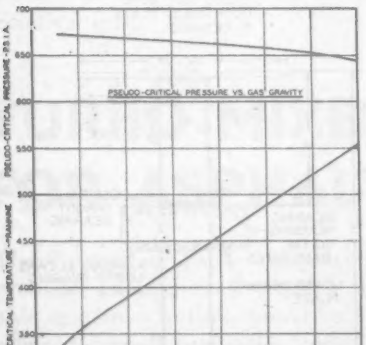

PSEUDO-CRITICAL PRESSURE VS. GAS GRAVITY
PSEUDO-CRITICAL TEMP VS. GAS GRAVITY
PSEUDO-CRITICAL PRESSURE - P.S.I.A.
PSEUDO-CRITICAL TEMPERATURE - °RANKINE
GRAVITY OF GAS (AIR=1.0)

Fig. 1—Pseudocritical properties of hydrocarbon gases (C.N.G.A. data)

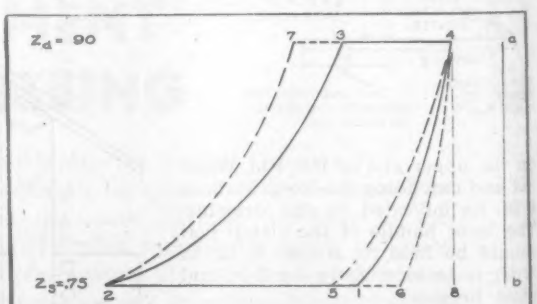


Fig. 2

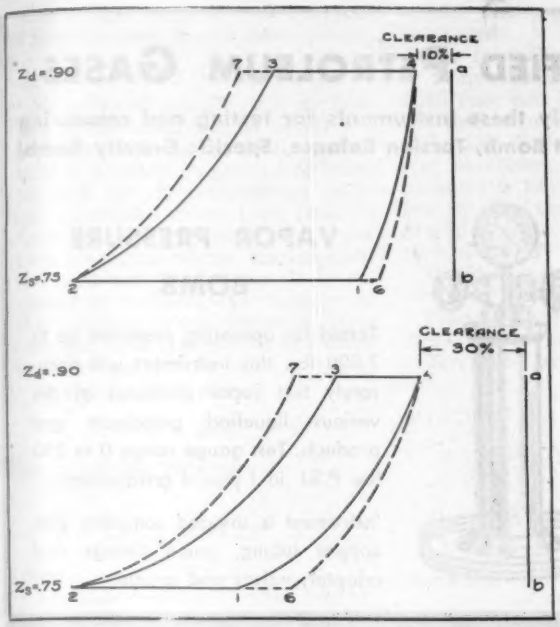


Fig. 3

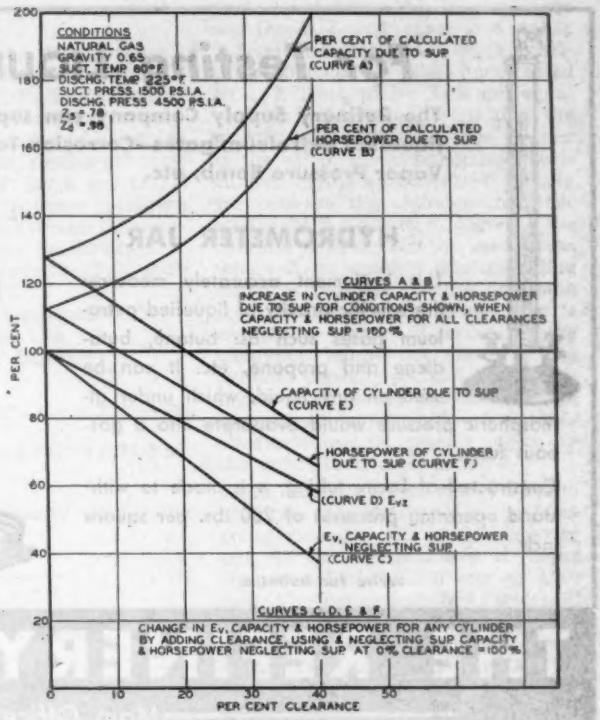

CONDITIONS
NATURAL GAS
GRAVITY 0.65
SUCT. TEMP 80°F.
DISCHG. TEMP 225°F.
SUCT. PRESS. 1500 P.S.I.A.
DISCHG. PRESS 4500 P.S.I.A.
Z_s=.78
Z_d=.98
PER CENT OF CALCULATED CAPACITY DUE TO SUP (CURVE A)
PER CENT OF CALCULATED HORSEPOWER DUE TO SUP (CURVE B)
CURVES A & B
INCREASE IN CYLINDER CAPACITY & HORSEPOWER DUE TO SUP FOR CONDITIONS SHOWN, WHEN CAPACITY & HORSEPOWER FOR ALL CLEARANCES NEGLECTING SUP = 100%
CAPACITY OF CYLINDER DUE TO SUP (CURVE E)
HORSEPOWER OF CYLINDER DUE TO SUP (CURVE F)
(CURVE D) E_{vs}
E_v, CAPACITY & HORSEPOWER NEGLECTING SUP. (CURVE C)
CURVES C, D, E & F
CHANGE IN E_v, CAPACITY & HORSEPOWER FOR ANY CYLINDER BY ADDING CLEARANCE, USING & NEGLECTING SUP CAPACITY & HORSEPOWER NEGLECTING SUP. AT 0% CLEARANCE = 100%
PER CENT
PER CENT CLEARANCE

Fig. 4—Effect of supercompressibility upon compressor cylinder operation for conditions shown

tions (using Dr. Brown's studies on pseudoreduced pressure[1]).

Cylinder Capacity

Without doubt, the clearest method of showing the effect of supercompressibility upon the capacity of the cylinder is the conventional indicator PV diagram, Fig. 2. The end of the discharge stroke, 4, is a point fixed only by the construction of the cylinder and is the proper starting point for such an analysis. The clearance volume, 4a, represents that which is in the cylinder head at the end of stroke of the piston. Under ideal gas laws the gas within this volume would reexpand back to point 1 according to the accepted volumetric efficiency formula:

$$E_v = K - C\,(R^{1/n} - 1) \qquad (1)$$

where the value for K is theoretically 1.0, but is frequently assumed to lie between 0.95 and 1.0 to allow for ring and valve leakages; C is the clearance in per cent, R is the ratio of compressions, and n is the exponent for the reexpansion. If the length of stroke 8, 2 is chosen as unity, then the length of the suction line 1, 2 is also the volumetric efficiency.

If the gas within the cylinder at discharge conditions has deviated from ideal gas laws and the compressibility factor is less than 1.0, the clearance volume 4a contains a greater weight of gas, or more standard cubic feet than would be contained in this volume under ideal gas laws. If this volume is reexpanded down to suction conditions, and if no deviation from the gas laws occurs at this point, then the volume occupied by the clearance gas becomes (b, 1)/Z_d or b, 5. The volumetric efficiency in such a case is represented by 5, 2.

Under most conditions as has been shown previously, when there is a deviation at discharge conditions, the deviation is still greater at suction conditions. In any event, whenever deviation exists at all under suction conditions the volume occupied by the reexpanded clearance gas must be reduced from b, 5 by the compressibility factor at suction, Z_s, which moves point 5 to point 6. (In Fig. 2 the compressibility factor at suction was smaller than that at discharge.) Thus we may say that the volumetric efficiency under conditions involving the "expanded" clearance volume at suction pressure under ideal gas law conditions by the ratio Z_s/Z_d. This can be written as follows:

$$1 + C - E_{vs} = (1 + C - E_v)\,Z_s/Z_s$$

$$E_{vs} = 1 + C - (1 + C - E_v)\,Z_s/Z_d \qquad (2)$$

where C = per cent cylinder clearance.

Or we can make the proper correction to the volumetric efficiency formula 1. Expanding the formula:

$$E_v = k + C - CR^{1/n}$$

The $CR^{1/n}$ term applies to the gas which is reexpanded, therefore this term must be corrected by Z_s/Z_d to permit the formula to apply under conditions of supercompressibility. Under such conditions:

$$E_{vs} = k + C - CR^{1/n}\,Z_s/Z_s$$

$$= k - C\,(R^{1/n}\,Z_s/Z_d - 1) \qquad (3)$$

It is obvious at this point that if the compressibility factor at suction is equal to the compressibility factor at discharge, even though they do not equal 1.0, the shape of the card is not changed, and $E_v = E_{vs}$.

Thus we have a method of finding the volumetric efficiency under conditions involving gases which deviate from ideal gas laws. This is essential for the next step, that of finding the capacity of the cylinder under these conditions.

The gas which was taken into the cylinder along the new suction line 6, 2 is "deviated" in proportion to the compressibility factor Z_s, and therefore to find the actual volume in standard feet of gas, the volume represented by 6, 2 must be divided by Z_s. We can now say that:

Cylinder capacity under conditions involving supercompressibility

$$= \text{Capacity calculated neglecting supercompressibility} \times \frac{E_{vs}}{E_v \times Z_s} \qquad (4)$$

$$= \text{Cylinder displacement} \times \frac{E_{vs} \times \text{Suct. PSIA} \times 520^\circ}{Z_s \times 14.7 \times (460 + t^\circ \text{ Suct.})} \qquad (5)$$

This formula can be used in either

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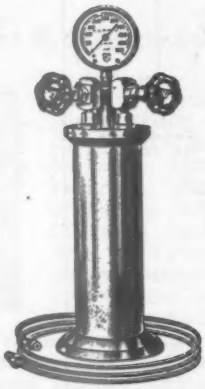

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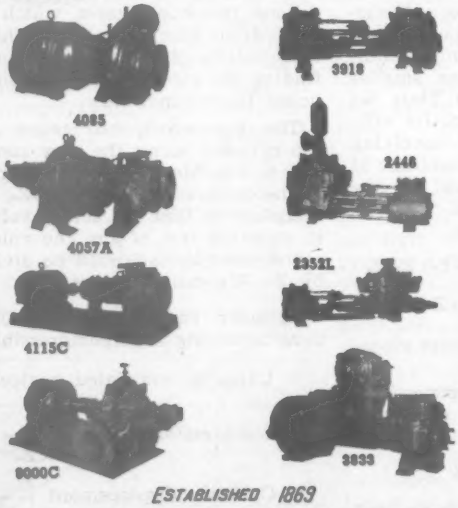

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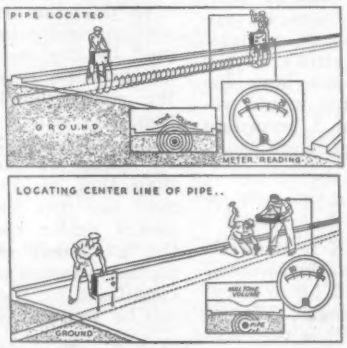

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form except when $E_v = 0$. Formula 5 must be used in this case.

Capacity Problem

In order to clarify the application of the foregoing, let us solve a problem involving cylinder capacity at high pressure. A gas of 0.65 gravity and 80° F. temperature is to be compressed from 1,500 psia. to 4,500 psia. in a cylinder of 15 per cent clearance whose displacement is 45,000 cu. ft. per day. It is required to compare the capacity of the cylinder when deviation from ideal gas laws is neglected and when it is recognized:

Neglecting deviation,

$$E_v = K - C(R^{1/n} - 1)$$

assuming the reexpansion
"n" = 1.2
K = 0.97
R = 4,500/1,500 = 3.0

then

$$E_v = 0.97 - 0.15(3^{1/1.2} - 1) = 0.745$$

Capacity in Std. cu. ft./day = disp. in C.F./day $\times E_v \times \frac{\text{Suct. psia.}}{14.7} \times \frac{520}{T^\circ \text{ Suct.}}$

$$= 45{,}000 \times 0.745 \times \frac{1{,}500}{14.7} \times \frac{520}{540}$$

$$= 3{,}290{,}000$$

For the computations when deviation is recognized: The compressibility factor at suction conditions is determined thus:

Pseudocritical pressure, $P_c = 670$ psia. (from Fig. 1).

Pseudoreduced pressure, $P_r = P/P_c = 1{,}500/670 = 2.24$.

Pseudocritical temperature, $T_c = 373°$ R. (from Fig. 1).

Pseudoreduced temperature, $T_r = T/T_c = 540/373 = 1.45$.

Compressibility factor at suction, $Z_s = 0.78$ (from Brown).

Similarly, the compressibility factor for discharge conditions can be calculated:

Also from Brown,[1] rising vertically from the suction condition of 1,500 psia. and 80° F., to 4,500 psia., the discharge temperature is seen to be 230° F. for a gas of 0.6 gravity. Similarly, the discharge temperature is 220° F. for a gas of 0.7 gravity. For the required condition of 0.65 gravity, an average temperature of 225° F. may be assumed.

Pseudoreduced pressure, $P_r = P/P_c = 4{,}500/670 = 6.72$

Pseudoreduced temperature, $T_r = T/T_c = 685/373 = 1.84$

$Z_d = 0.98$ (from Brown[1])

$$E_{vs} = 1 + C - (1 + C - E_v) \times Z_s/Z_d \quad (2)$$

$$= 1.15 - (1.15 - 0.745) \times 0.78/0.98$$

$$= 0.828$$

Capacity = capacity neglecting deviation $\times \frac{E_{vs}}{E_v \times Z_s}$ (4)

$$= 3{,}290{,}000 \times \frac{0.828}{0.745 \times 0.78}$$

$$= 4{,}690{,}000 \text{ std. cu. ft. per day}$$

Thus, due to supercompressibility, the capacity of the cylinder under these conditions has been shown to be greater by $\frac{4.69 - 3.29}{3.29} = 42.5$ per cent.

Effect of Clearance

Formulas 4 and 5 being related to volumetric efficiency indicate that the correction factors obtained therefrom vary with the per cent of cylinder clearance. The reason for this is apparent from the diagrams of Fig. 3. If the clearance volume 4a is small, then the volume b1 is small, and so is the Z_s/Z_d correction to it, 6, 1. When the clearance 4a is large, b1 is also large and the Z_s/Z_d correction to it makes 1, 6 much larger and a much greater proportion to the uncorrected E_v, 1, 2. Thus, where Z_s is not equal to Z_d it becomes apparent that the greater the clearance, the greater is the effect of deviation upon calculated cylinder capacity. Normally we increase the cylinder clearance whenever we desire to decrease the cylinder capacity. In the usual case, where Z_s is smaller, this unloading effect is reduced by the deviation from ideal gas laws. Indeed, one is entitled to wonder if increasing the clearance might not increase the cylinder capacity instead of decreasing it. Such is not the case, though the unloading effect due to adding clearance can be greatly offset by the application of Formula 2.

The curve of Fig. 4 is shown to illustrate this effect. As in the foregoing example, gas of 0.65 gravity and 80° F. temperature is being compressed from 1,500 psia. to 4,500 psia. The compressibility factors at suction and discharge are noted. In curve A, cylinder clearances up to 40 per cent are plotted against the per cent increase in cylinder capacity due to supercompressibility. This curve shows that for a clearance of 40 per cent the cylinder can be expected to handle 201 per cent of the volume calculated neglecting the deviation. At 0 per cent clearance there is obviously no volumetric efficiency correction. The increase of capacity to 128 per cent at this point is merely $1/Z_s$ or 1/0.78. Although horsepower has not been discussed as yet, it is plotted as curve B to make the group complete and to correspond with curve A. It is obtained merely by multiplying the per cent increase in capacity as shown in curve A by 61.6/70, which is the ratio of horsepower per million standard cubic feet per day when recognizing supercompressibility to the horse-

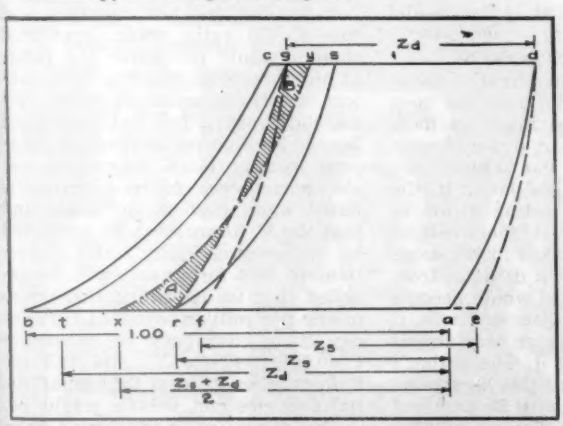


Fig. 5

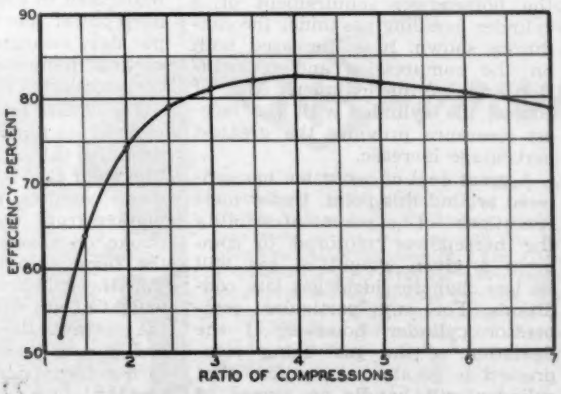


Fig. 6—Ratio of $\frac{\text{theoretical horsepower}}{\text{brake horsepower}}$ for modern angle compressor. (Combined compression and mechanical efficiencies)

power factor neglecting it. Curve C shows the decrease in cylinder capacity and horsepower with increase of clearance when no deviation occurs, using the capacity of 0 per cent clearance as 100 per cent. This curve merely constitutes a plot of the normal volumetric efficiency versus clearance relationship. Similarly, curve D plots E_{vs} and shows the decrease in capacity and horsepower due to adding clearance, when the capacity and horsepower at 0 per cent clearance are taken as 100 per cent, and the computations are corrected for the deviation from ideal gas laws, according to the foregoing. The comparison of curve D with curve C shows the reduction in the unloading effect of adding clearance due to the deviation under these particular compressibility factors. Curves E and F are plotted to show the capacity and horsepower due to supercompressibility if the capacity and horsepower of the same cylinder at 0 per cent clearance neglecting the deviation equals 100 per cent.

Horsepower Requirement

The effect of supercompressibility upon the horsepower of the cylinder is clearly shown on the indicator diagram. In a manner similar to that by which we corrected the reexpansion line, we can also correct the compression line. On Fig. 3 where Z_d is greater than Z_s (greater deviation from ideal gas laws at suction conditions) it is apparent that as the gas is being compressed, the deviation thereof will be reduced, and it will occupy a greater volume than it would have done had the deviation remained unchanged. By applying the ratio of compressibility factors at various pressure increments to those at intake conditions and correcting for the slight temperature differences, the true compression line can be plotted. This is shown on Fig. 3 as 2, 7. It is obvious what happens to the horsepower requirement of a cylinder handling gas under the conditions shown. It is increased both on the compression and reexpansion ends of the cylinder. And, of course, the cylinder with the largest clearance provides the greatest percentage increase.

A great deal of confusion has centered around this point. Under most conditions of supercompressibility the horsepower required to compress a given weight of gas will be less than for ideal gas law conditions. For any particular compressor cylinder, however, if the deviation of the gas being compressed is greater at suction, that cylinder will handle an excess of gas great enough to more than offset the reduced horsepower per pound, and for this reason the horsepower required by the cylinder will be increased beyond the requirement for gases which do not deviate from ideal gas laws. From the indicator diagram it will be apparent that the only condition for which the size of the card (and therefore the horsepower of the cylinder) will be unchanged under conditions where the gas deviates from ideal gas laws will be that where the compressibility factor is the same at discharge as it is at suction conditions. In such a case the cylinder will handle an increased weight of gas as compared to ideal gas law conditions, due to Z_s in the denominator of Formula 4. Because the horsepower for this cylinder is unchanged, then obviously the horsepower per pound is reduced. Usually, however, Z_s is less than Z_d and therefore we can generalize by saying that under most conditions of supercompressibility, the "horsepower per million" is decreased, but the horsepower per cylinder is increased. It is obvious that we must not confuse the two cases.

Horsepower by Approximate Method

Since from the foregoing we can determine the capacity of any cylinder when handling gas which deviates from gas laws, we have only to know how to obtain the horsepower per pound, or per million standard feet of gas under such conditions in order to determine the horsepower required for the cylinder. Several methods have been developed to provide it. The author has developed a very rapid approximate method which, in the solution of a number of problems covering a wide range of conditions, has given a maximum error of 2 per cent. This method of determining the horsepower requirement consists of averaging the compressibility factor at suction with that at discharge and taking the average as the per cent by which the horsepower per million neglecting supercompressibility is multiplied to find the corresponding horsepower per million cubic feet per day, measured at 14.7 psia. and suction temperature when supercompressibility is considered.

Fig. 5 is shown, slightly exaggerated, to illustrate what has been done in this approximate method. The solid card a, b, c, d would exist when compressing gas without deviation from the gas laws. If the stroke on a single acting piston in the same cylinder is shortened so that the cylinder takes in the same weight of gas when it deviates from the gas laws, the card would become e, f, g, d. If we displace e, f to a, r, card a, r, g, d defines an area almost identical to e, f, g, d. The author's method of obtaining the horsepower by averaging Z_s with Z_d produces the card a, x, y, d. The amount by which area A differs from area B in per cent of the total card is the major error in this assumption. Obviously, in the case where Z_s equals Z_d, the "n" values are not changed and this method is exact. In such a case the card would be a, r, s, d.

The statement was made that the greatest error found in the author's method of approximating the horsepower was 2 per cent. What was considered to be the exact horsepower requirement was obtained by the tedious method of accurately plotting the normal indicator card to scale, then correcting it for supercompressibility at numerous intermediate pressure levels on the compression stroke by the ratio Z_p/Z_s and $T°_{sp}/T°_p$. For the reexpansion line correction, the clearance gas was corrected by the ratio Z_p/Z_d for several pressures. The areas of the normal and the supercompressibility cards were then accurately measured. After correcting for the increased weight of gas in the cylinder when it had deviated from ideal gas laws, the horsepower per unit weight of gas was obtained for both cases. The ratio of the two was then obtained. This ratio was then applied to the accepted brake horsepower charts to provide the exact B.H.P./M.M.C.F. for compression involving supercompressibility. This laborious method was only used to check the accuracy of the several methods of making horsepower determinations.

Horsepower by Average "n"

Edmister[4] has suggested that the horsepower required for hydrocarbons which deviate from ideal gas laws might be closely approximated if we knew the "n" value of the compression line both at the beginning and the end of compression, and used the average of the two in the theoretical horsepower formula:

$$HP = \frac{144\,P_1\,V_1}{33{,}000}\left(\frac{n}{n-1}\right)\left(R^{\frac{n-1}{n}}-1\right)$$

This article dealt with hydrocarbons at relatively low pressures, and the C_p/C_v ratio table presented therein would not cover the range of high pressures which are the subject of this discussion. However, the method gives a fair approximation for the horsepower in the high pressure area, provided we realize that the horsepower formula above is based upon perfect gas laws, and that the V_1 term must be corrected by the compressibility factor at suction. In this formula it will be recalled that to determine the horsepower per million standard feet per day it is customary to substitute 1,000,000/1,440 for V_1, and 14.7 for P_1, regardless of what the actual initial pressure and volume might be. Such a procedure is predicated upon the assumption that Boyle's law

holds, and that the term $P_1 V_1 = k$. When Boyle's law does not hold, the product of $P_1 V_1$ will likely be much smaller at suction conditions than at atmospheric pressure. Hence, to make it correct for the proper suction pressure we must multiply $P_1 V_1$ at atmospheric pressure by Z_s. In our concept of horsepower[4] we should recall the definition for work, which is the product of force times distance. If the gas deviates from Boyle's law, and the volume of gas to be compressed occupies a space smaller than Boyle's law would indicate, then the distance through which the force (piston) must act is reduced, and the work, and thus the horsepower per pound, is lessened.

The method of determining the horsepower by use of the average "n" is tedious but not difficult. The slope at the extreme ends of the compression line after making the supercompressibility and temperature corrections is determined by the familiar graphical solution, well described by Gill.[6] The average provides the "n" value needed. When someone provides us with C_p/C_v ratios ("n" values) which will exist at suction and discharge conditions at the pressures being considered, this method of calculating the horsepower requirement will be greatly simplified. Differences up to 9 per cent between this "average n" and the "exact" methods, previously described, have been noted when used in the high-pressure range. Values so determined are nearly always low.

Horsepower From Mollier Diagrams

A simple method of finding the horsepower per pound or per million standard feet per day has been worked out for us by Dr. Brown in the Entropy-Enthalpy or Mollier diagrams for natural gases.[3] His diagrams recognize the deviations from ideal gas laws. The enthalpy, or total heat in B.t.u. can be read at a point corresponding to suction conditions, and by assuming that the work of compression follows the adiabatic path of constant entropy, a vertical rise to discharge conditions will indicate the B.t.u. enthalpy at this level. The difference, expressed in B.t.u., is the work done in raising 1 lb. mole of the gas from suction to discharge conditions. This can readily be converted to horsepower per million standard cubic feet per day from the knowledge that 1 lb. mole of gas occupies 379 cu. ft. at 14.7 psia. and 60° F. if $Z = 1.0$. And at standard conditions of pressure and temperature, any "deviation" is negligible and Z can be assumed to be 1.0.

Thus, for any of the Mollier diagrams, the B.t.u. difference shown for compressing the gas from one condition to another is the B.t.u. required to compress 379 standard cu. ft. through this range. Knowing that 1 B.t.u. = 778 ft.-lb. we can determine the conversion factor from B.t.u. to theoretical horsepower per million standard feet per day by the expression:

$$\text{Theoretical Hp./M.M.s.c.f./day} = \frac{\Delta\text{B.t.u.} \times 1{,}000{,}000 \times 778}{379 \times 24 \times 60 \times 33{,}000}$$

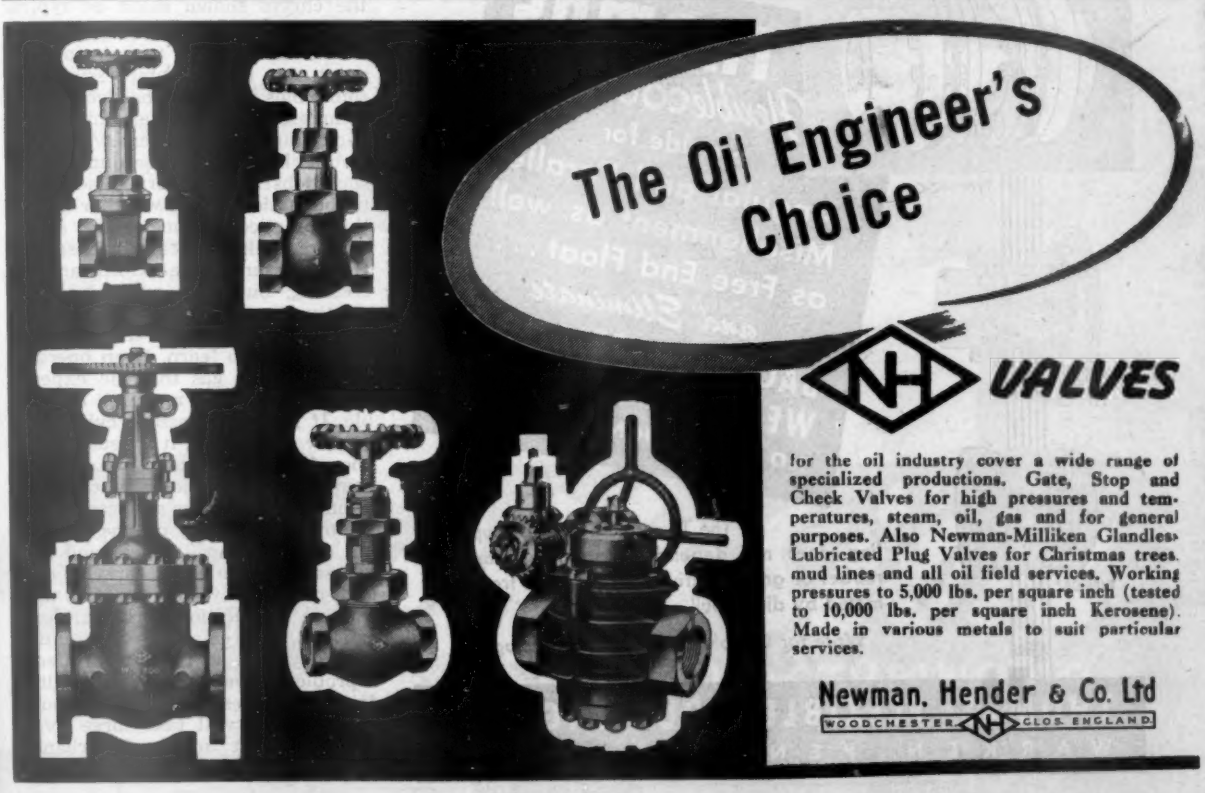
$$= \Delta\text{B.t.u.} \times 0.0432$$

It must be remembered that the Mollier charts provide B.t.u. per pound-mole, and therefore the horsepower determined therefrom will be the horsepower per million standard feet per day, when the gas is at the suction temperature which was used in reading the Mollier chart.

By application of the proper factors, this theoretical horsepower can be converted to brake horsepower. The factors involved are the compression efficiency, which represents principally the compressor valve losses, and the mechanical efficiency of the compressor. These losses vary with the design of equipment, speed, ratio of compression, etc. A comparison of the theoretical horsepower required per million cubic feet per day at 14.7 psia. and suction temperature:

$$\text{Hp.} = 44.6 \times \frac{n}{n-1}\left(R^{\frac{n-1}{n}} - 1\right)$$

and the charts showing brake horse-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power per million for hydrocarbons as published by Worthington[1] indicate that these combined efficiencies vary with ratio of compression as shown on Fig. 6. These efficiencies can be used for the determination of brake horsepower from the theoretical horsepower obtained from the Mollier charts.

Horsepower Problem

When applied to the same problem which was used to demonstrate the capacity calculations, we can determine the horsepower requirements by the author's method as follows: Averaging the compressibility factors,

$$\frac{Z_s + Z_d}{2} + \frac{0.78 + 0.98}{2} = 0.88$$

(The "exact" method as described above gave a factor 1.6 per cent lower than this.)

B.h.p./M.M.s.c.f./day neglecting supercompressibility=70.0 (from B.h.p charts).

B.h.p./M.M.s.c.f./day recognizing supercompressibility = 70 × 0.88 = 61.6. The decrease due to supercompressibility is 12 per cent.

The capacity of the cylinder was previously shown to be increased to 4,690,000 std. cu. ft. per day under conditions of supercompressibility, therefore the

B.h.p. for the cylinder = 4.69 × 61.6
= 289

If supercompressibility were neglected, the load on this cylinder would be calculated to be 3.290×70.0 = 230 B.h.p.

The load increase due to the deviation from ideal gas laws is obviously

$$\frac{289 - 230}{230} = 25.6 \text{ per cent}$$

The problem is a typical one. The capacity of the cylinder has been increased 42.5 per cent. The brake horsepower per million per day has been reduced 12 per cent by the effect of the deviation, but this gain in unit horsepower has been more than offset by the increase in cylinder capacity, resulting in an increase in cylinder horsepower of 25.6 per cent. Curve B of Fig. 4 shows the percentage increase in horsepower due to supercompressibility for cylinders of various clearances, operating under the same conditions that were used for this problem. Certainly the wide differences caused by this phenomenon are of such an order of magnitude that they cannot be ignored. The conditions of gravity, temperature and compression ratio are probably quite similar to those found in cycling plants, hence the curves shown could be typical of actual field conditions.

One is entitled to ask, at this point, that if supercompressibility is sometimes ignored when computing compressor sizes or determining capacity and horsepower, why more trouble has not been encountered on such jobs? In the first place, it is problematical as to whether or not this practice of neglecting supercompressibility is really widespread. High-pressure installations are increasing, but their number is still relatively small, and what trouble has been caused from this source is rather hard to learn. If an operator handles more gas than he expects, he doesn't usually regard it as trouble. If his high-pressure cylinder is greatly overloaded, it is usually only one of several cylinders on a single compressor, and the other cylinders often work on other services so that the overload is only on one cylinder out of the group. If a gas and load excess occurs on a unit carrying only high-pressure cylinders, removal of a valve or addition of extra clearance usually remedies the situation so easily that it is not considered a problem. The modern gas-engine-driven compressor is so "overpowered" that it will take large overloads without much disturbance. Frequently the gas in a repressuring

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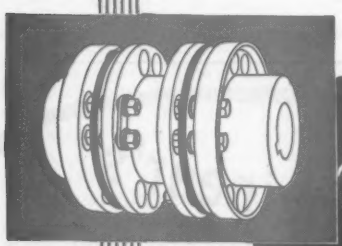
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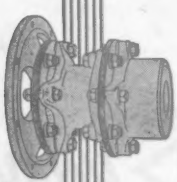
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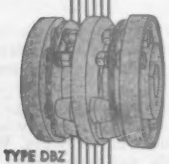
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or cycling plant is two-staged, with cylinders of both stages on each compressor. In such cases the low-pressure cylinder is usually not greatly affected by supercompressibility. The high-pressure cylinder probably is. But the volume handled by each compressor unit is fixed by the capacity of the low-pressure cylinder, therefore the excess capacity of the high-pressure cylinder due to gas law deviation only serves to lower the intermediate pressure, and therefore no appreciable increase in capacity for the unit is obtained. Because the intermediate pressure is reduced, the load is reduced on both the low and the high-pressure cylinders.

Even though the discrepancies described above may not, in some cases, be too hard to rectify, there is little excuse for us to make them. With the methods so easy to use we should size the cylinders to handle the correct throughput and be able to predict the correct horsepower requirement when gases deviate from ideal gas laws.

Above all, we should not fail to take advantage of the marked reduction in the horsepower requirement for compression due to supercompressibility. In the high-pressure regions, reductions of 15 per cent are common. Cycling plants frequently process huge volumes to high pressures and require large compressor installations. A reduction of 15 per cent in horsepower in such cases represents no small saving in money. In a recent cycling-plant installation, taking advantage of the reduction in horsepower due to supercompressibility meant the elimination of one compressor unit which, including installation costs, represented a saving that ran into six figures.

The methods which have been presented above will permit computations for compressor cylinder capacity and horsepower under conditions of supercompressibility to be made with good accuracy. They are simple and easy to use. It is hoped that the illustrations regarding the magnitude of the errors involved by neglecting the deviation from ideal gas laws in regions where it should be considered, and the savings which may be made by recognizing this effect, have been sufficiently convincing to encourage common use of these methods.

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4. "Specific Heat Ratios for Hydrocarbons," W. C. Edmister, Ind. & Eng. Chem., March 1940, p. 373.
5. See "Air and Gas Compression," T. T. Gill, (Wiley) p. 18.
6. See "Air and Gas Compression," T. T. Gill (Wiley) p. 51.
7. "Plain Talks on Air and Gas Compression," vol. IV, Worthington Pump & Mach. Corp.

R. L. Kidd, chief geologist of the Bartlesville division of Cities Service Oil Co., has been appointed vice president and manager of the Land and Geological Division of the company. He succeeds **J. M. Nisbet,** who has resigned effective June 1 to return to California. Kidd is a 20-year man with the company, having first joined it in July of 1925. **A. K. Wilhelm** will replace Kidd as Chief Geologist of the Bartlesville Division.

W. G. Skelly, Tulsa, president of Skelly Oil Co., was recently presented a gold medal for "outstanding service" to the Army ordnance department. Skelly was one of the Tulsans active in forming, a few months ago, the Army Ordnance Association.

G. L. Brennan of Warren Petroleum Co., Tulsa, was reappointed chairman of the Gas Specifications Committee of the Liquefied Petroleum Gas Association.

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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Reducing Sulfur by Cobalt Molybdate

We read a lot about processes for removing sulfur but none of them seem to be applicable to our high-sulfur crude oils of Wyoming. What are the best processes for the removal of large amounts of sulfur?—A.J.J.

It is correct that many processes have been developed for reducing the sulfur content of already somewhat low-sulfur stocks, and that little can be done with stocks that contain large amounts of sulfur. Many of our processes, notably doctor sweetening, copper sweetening, and lead sulfide treating, do not remove sulfur but merely convert mercaptan sulfur compounds into disulfide sulfur compounds that are only less objectionable than mercaptans.

The reason for the widespread interest in treating processes that are applicable only to somewhat low-sulfur stocks, is the fact that an extremely low-sulfur content is valuable from the standpoint of lead susceptibility or octane-number improvement. Thus the octane number in the presence of tetraethyl lead is only mildly improved by reducing the sulfur content to 0.1 per cent or even to 0.01 per cent, whereas a further reduction to 0.005 per cent sulfur results in a definite increase in leaded octane number. In producing gasolines of extremely high octane number (aviation fuels) it is almost imperative that the sulfur content be reduced to 0.01 per cent or less. In addition, even extremely small amounts of free sulfur, hydrogen sulfide, or mercaptan compounds are objectionable and they must be almost completely removed in order to produce a non-corrosive odor-free gasoline.

Types of processes.—The processes by which sulfur compounds are removed or converted into other compounds may be grouped as follows:

1. Conversion of mercaptans to disulfides. Examples of such processes are doctor or copper sweetening, and lead sulfide treatment.

2. Solvent extraction. Sulfuric acid was for many years the only widely used method for dissolving sulfur compounds from gasolines, particularly from cracking-still distillate. Caustic soda absorbs hydrogen sulfide and to a limited extent mercaptans. Certain chemical agents, when added to caustic soda greatly increases its ability to dissolve mercaptans, e.g., the Solutizer and Unisol processes.

3. Decomposition of sulfur compounds into hydrogen sulfide. The Perco catalytic desulfurization process is an example. Not all sulfur compounds are decomposed and hence the sulfur content of many high-sulfur stocks is not greatly improved by the process. The hydrogen sulfide can be fractionated from the gasoline, or removed by caustic soda.

Today's Main Processes

These processes are the main ones today. The first group (conversion processes) result in no sulfur removal. Among the solvent processes (group 2) only sulfuric acid treatment can result in large reductions in sulfur content, and it is not entirely satisfactory because the acid dissolves much of the gasoline as well as the sulfur compounds and because the extraction should be conducted at the low temperature of 50° F. or lower. Group 3 processes by which sulfur compounds are decomposed to hydrogen sulfide work well on stocks of relatively low-sulfur content (0.15-0.05 per cent, but are not suitable for high-sulfur stocks.

Catalytic hydrogenation and desulfurization.—Most recently interest has centered on decomposition processes conducted in the presence of hydrogen. Catalysts other than bauxite or hydrated silicate of aluminum are being employed either separately or suspended on a carrier. Common catalysts are oxides of nickel or cobalt, and molybdates of cobalt, nickel or iron. In developing the cobalt molybdate process (Byrns, Bradley & Lee—Ind. Eng. Chem. 35, 1160, 1943), ironore, nickel aluminate aluminum molybdate, copper molybdate, zinc molybdate, molybdic oxide, and cobalt oxide were also studied. These processes are said to permit operation at only 650°-700° F. and to operate for long periods of time without decrease in catalyst activity.

The Cobalt molybdate process (see reference above) has been studied in the laboratory and in a pilot plant by Union Oil Co. of California. The process decomposes sulfur compounds, even the very stable thiophenes and disulfides, into hydrogen sulfide which can be fractionated out of the final gasoline as in the Perco catalytic desulfurization process. In the laboratory experiments the gasoline vapors were given a pretreat with clay at a temperature of 400° F. probably for the polymerization of olefinic or reactive materials that would tend to accumulate on the surface of the real cobalt molybdate catalyst. Hydrogen is also used and it probably assists in keeping the catalyst clean as well as to contribute to the large yield of 99 per cent that is produced. Products containing only 0.01 or 0.02 per cent sulfur were produced from high-sulfur (0.63-3.0 per cent) stocks. The products contain relatively large amounts of gum.

The major significance of the cobalt molybdate process is the fact that it is one of the two processes now available for reducing the sulfur content of high-sulfur stocks. Sulfuric acid treatment for reduction of sulfur involves such large losses that it has not been universally successful, and hence the new cobalt process may emerge as the first really satisfactory sulfur-reduction process.

Dictionary of Petroleum

Can you tell me where I can find a good petroleum dictionary covering words and phrases used in the oil and gas industry?—J. R.

There is a real need for a comprehensive dictionary of petroleum terms. The Petroleum Dictionary for Office, Field and Factory, second edition, 1936 by the late Hollis P. Porter, is probably the only such book. It is published by Gulf Publishing Co. of Houston.

The language of science and industry changes so rapidly and there are such fine refinements of meanings that scarcely any scientific dictionaries have been attempted even in such advanced sciences as chemistry or chemical engineering. Only for the most casual or general purposes are scientific dictionaries of any service. For specific meanings, such as required in legal controversies, dictionaries are of little value or may be misleading. In such situations the meanings of words or phrases must be determined by a careful inspection of books, trade literature, current (or ancient) magazine articles, patents, etc., by a technologist who is widely experienced in the particular industry or branch of industry involved.

When the Questions on Technology page in The Oil and Gas Journal was conducted by the late C. K. Francis, the meanings of many oil-industry terms were discussed but these discussions pertain mainly to petroleum refining.

Oil Recovery by Expansion With Primary Gas Cap

*by Park J. Jones**

PART 27 OF A SERIES

THIS article considers oil recovery by expansion from reservoirs having a primary gas cap. Methods for estimating oil recovery by expansion of evolved solution gas and primary gas cap are derived and illustrated by examples. The benefits resulting from nonproduction of gas-cap gas are threefold: (1) Much higher oil recovery per unit decline in pressure; (2) faster rate of recovery, and (3) larger fraction of ultimate recovery is flowed rather than pumped.

In numerous cases, gas-cap gas is produced because of adverse economic conditions. Royalty and working interests underlain by gas are not given sufficient equity in a reservoir by the royalty and working interests underlain by oil. The differences could be adjusted and conflicting interests reconciled if the royalty and working interests underlain by oil would realize that in most instances the value of their properties is increased anywhere from 50 per cent up to 150 per cent by not producing gas-cap gas. If a fair share of the increase in value were assigned to the royalty and working interests underlain by gas, benefits would accrue to both parties. An example is included to show the advantages resulting from nonproduction of gas-cap gas.

Mechanics of Producing Oil, Condensate, and Natural Gas

Initial Gas-Oil Ratio

IF a reservoir has a primary gas cap, the quantity of gas G_i initially associated with a barrel of oil is derived as follows:

Initial reservoir pressure = P_i, psia.
Reservoir space = S bbl.
Fraction of reservoir space initially occupied by reservoir gas = y
Reservoir space initially occupied by free gas = yS bbl.
Fraction of reservoir space initially occupied by reservoir liquid = 1 — y
Reservoir space initially occupied by reservoir liquid = (1 — y)S
Gas in solution at pressure $P_i = g_i$ cu. ft./bbl. of oil
Volume factor at pressure P_i for oil = b_i bbl. space/bbl. oil
Volume factor at pressure P_i for free gas = $B_i = 0.00504\ TZ_i/P_i$ bbl. space/cu. ft. gas.

It follows from the foregoing considerations that

Barrels of oil initially in place = $(1 - y)S/b_i$
Cubic feet of gas in solution = $g_i(1 - y)S/b_i$
Cubic feet of free gas initially in place = yS/B_i
Cubic feet of solution plus free gas = $S\,[g_i/b_i\,(1 - y) + y/B_i]$

But the gas in place divided by the oil in place is equal to G_i the initial gas-oil ratio. Accordingly

$$G_i = g_i + \frac{b_i}{B_i}\left(\frac{y}{1-y}\right) \qquad (1)$$

Equation 1 states that the number cubic feet of gas initially associated with a barrel of oil in a reservoir having a primary gas cap is equal to the cubic feet of gas in solution plus a constant. The constant is equal to the product of volume factor ratios b_i/B_i and reservoir space ratio $y/(1-y)$. The larger the primary gas cap the higher the initial gas-oil ratio.

If there were no primary gas cap, y would equal to zero and the initial gas-oil ratio G_i would be equal to g_i the cubic feet of gas initially in solution.

*Production consultant, Houston.

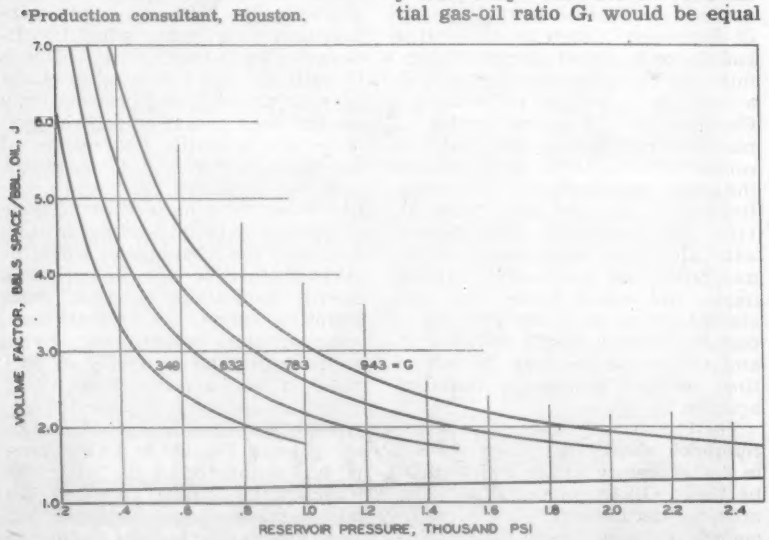

Fig. 27-1—Volume factor vs. pressure in a reservoir having a primary gas cap

Volume Factor for Oil

The initial volume factor J_i for oil associated with free gas is defined by

$$J_i = b_i + B_i(G_i - g_i) = b_i/(1 - y) \qquad (2)$$

The volume factor J at a pressure P which is less than the initial pressure P_i is defined by

$$J = b + B(G - g) \qquad (3)$$

where
b = volume factor for reservoir liquid
B = volume factor for free gas
g = gas in solution, cu. ft./bbl. oil
(G — g) = free gas associated with a barrel of oil
G = all the gas associated with a barrel of oil.

The curves in Fig. 27-1 are solutions of Equation 3 for a particular reservoir under the following conditions:

Volume of primary gas cap = 30 per cent of total reservoir space
Gas initially in solution = 567 cu. ft./bbl. of oil.
Solution gas plus free gas = 943 cu. ft./bbl. of oil
Free gas = 943 — 567 = 376 cu. ft./bbl. of oil.

The bottom curve gives the vol-

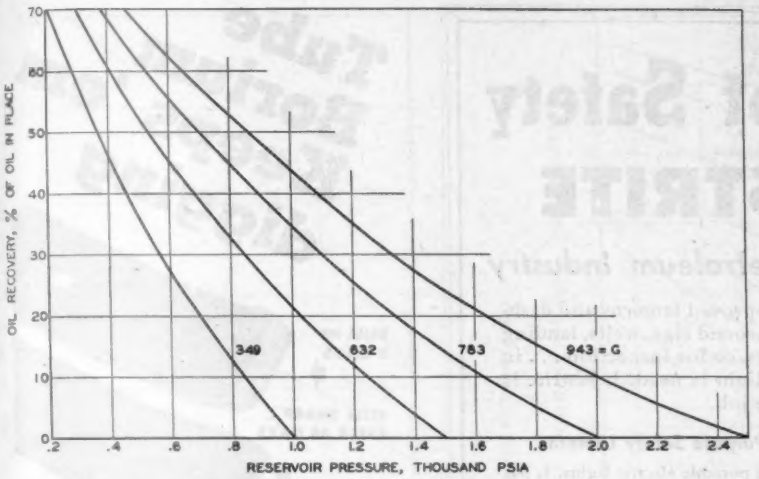

Fig. 27-2—Per cent oil recovery vs. reservoir pressure and (G) gas-oil ratio in reservoir

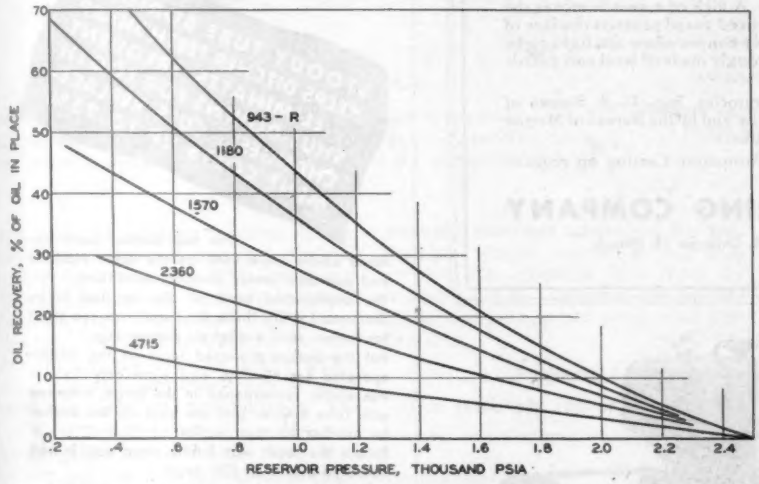

Fig. 27-3—Per cent oil recovery vs. reservoir pressure and (R) produced gas-oil ratios

ume factor b for reservoir liquid alone. The other curves give the volume factor J for oil plus free gas. The numbers 943, 783, etc., represent the solution plus free gas associated with a barrel of oil. The data in Fig. 27-1 will be used to illustrate the methods used in estimating oil recovery from reservoirs having primary gas caps.

Per Cent Oil Recovery

The number of barrels of oil initially in place is equal to S/J_i where S is barrels of reservoir space and J_i is defined by Equation 2. Let the cumulative oil recovery as of a given date be denoted by C bbl. and volume factor corresponding to the reservoir pressure when C barrel of oil have been recovered, by J which is defined by Equation 3. Then the oil remaining in place is S/J and

$$C = S(1/J_i - 1/J) \qquad (4)$$

Now the per cent oil recovery r is equal to the cumulative oil recovery divided by the oil initial in place and expressed in per cent. Accordingly,

$$r = 100\left(1 - \frac{J_i}{J}\right) \qquad (5)$$

The curves in Fig. 27-2 are solutions of Equation 5 for the data in the preceding figure. A set of curves of the type shown in Fig. 27-2 give the per cent oil recovery from a reservoir in terms of average reservoir pressure and the gas-oil ratio for the oil remaining in a reservoir. Per cent oil recovery could be estimated if we know which curve to use at a given time, that is, if we know the gas-oil ratio for the oil remaining in a reservoir. For field purposes, it is more convenient to express oil recovery in terms of produced gas-oil ratios.

Oil Recovery vs. Produced Gas-Oil Ratio

Per cent oil recovery can be estimated in terms of the produced gas-oil ratio. This conclusion is reached by the following steps: Let the cumulative produced gas-oil ratio be denoted by R. For reservoirs having a primary gas cap, let R be expressed in terms of G_i the initial gas-oil ratio. For example, if the initial gas-oil ratio is 943 cu. ft./bbl. of oil and the cumulative produced gas-oil ratio as of a given date is 1,886 cu. ft./bbl. of oil, the value of R in this case would be 1,806/943 or 2.0.

Let the fraction of oil produced from a reservoir be denoted by r. Then

The fraction of gas produced = rR

The fraction of gas not produced = 1 — rR

The fraction of oil not produced = 1 — r

So the gas-oil ratio G in a reservoir is defined by

$$G = \frac{1 - rR}{1 - r} \qquad (6)$$

from which

$$r = \frac{1 - G}{R - G} \qquad (7)$$

The curves in Fig. 27-3 are solutions of Equation 7 for the data given in Fig. 27-2. A set of curves of this type give per cent oil recovery in terms of produced gas-oil ratios and average reservoir pressure. Average reservoir pressure means the average pressure on the free gas in a reservoir.

Example 1

Estimate the oil recovery from a reservoir (having no water encroachment and for which the curves in Fig. 27-3 apply) by the time reservoir pressure declines from 2,500 psia. down to 1,000 psia. (Table 1).

TABLE 1

Produced gas-oil ratio	4,715	2,360	1,570	1,180	943
Per cent oil recovery	9.4	19.2	27.8	36.2	43.9
Barrels of oil per million barrels in place	94,000	192,000	278,000	362,000	439,000

This example is illustrative of the effect of gas-oil ratios on oil recovery by expansion.

Control of Gas-Oil Ratios

Control of gas-oil ratios for reservoirs having sizable gas caps is most easily achieved physically by not producing gas cap gas. Economically, the benefits resulting from nonproduction of gas cap gas are threefold: (1) a much higher oil recovery per unit decline in reservoir pressure, (2) a faster rate of recov-

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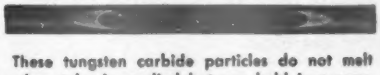

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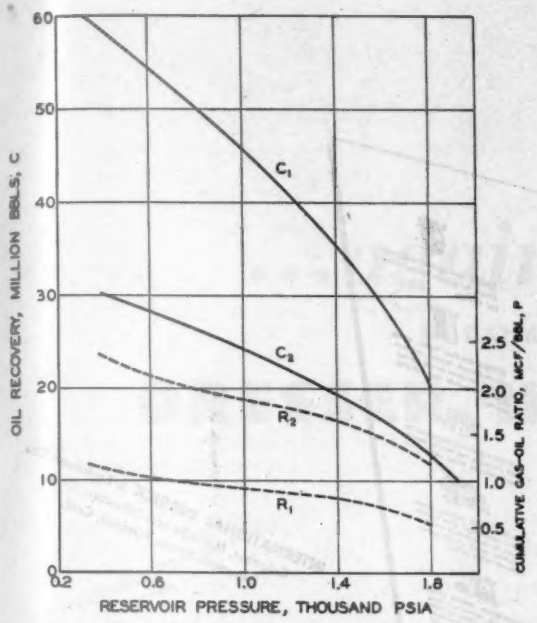


Fig. 27-4—Oil recovery vs. reservoir pressure for Example 2; C_1, oil recovery without producing gas-cap gas; C_2, oil recovery when gas-cap gas is produced; R_1 and R_2, cumulative gas-oil ratio

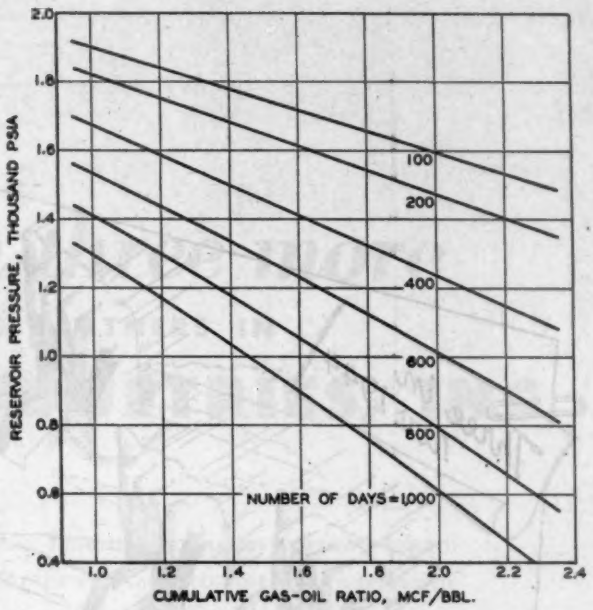


Fig. 27-6—Pressure vs. gas-oil ratio and time; producing rate equals 10,000 bbl. per day. (See Example 4)

ery, and (3) a larger fraction of the ultimate recovery can be flowed rather than pumped. The foregoing benefits commonly are not obtained because of economic difficulties. Royalty and working interests underlain by gas are not given sufficient equity by the royalty and working interests underlain by oil.

The differences could be adjusted and conflicting interests reconciled if the royalty and working interest underlain by oil would realize that in most instances the value of their properties is increased anywhere from 50 per cent up to 150 per cent by not producing gas-cap gas. If a fair share of the increase in value were assigned to the royalty and working interests underlain by gas, benefits would accrue to all concerned. An example will now be worked out to illustrate the advantages inherent in not producing gas-cap gas.

Example 2

The reservoir represented by the curves in Fig. 27-3 initially contains 100 million barrels of oil, 56.7 billion cubic feet of solution gas, and 37.6 billion cubic feet of gas-cap gas. If the gas-cap gas is not produced, the probable producing gas-oil ratios are as shown in Table 2.

On the other hand, if the gas-cap gas is produced, the number and location of wells are such that the probable producing gas-oil ratios are as shown in Table 3.

TABLE 2

Million barrels of oil	10	10	10	10	10	10
Going gas-oil ratio	567	700	900	1,200	1,600	2,100
Cumulative gas-oil ratio	...	634	722	842	993	1,178
Per cent recovery	...	20	30	40	50	60

TABLE 3

Million barrels of oil	5	5	5	5	5	5
Going gas-oil ratios	1,000	1,400	1,800	2,400	3,200	4,900
Cumulative gas-oil ratio	....	1,200	1,400	1,650	1,960	2,360
Per cent oil recovery	...	10	15	20	25	29

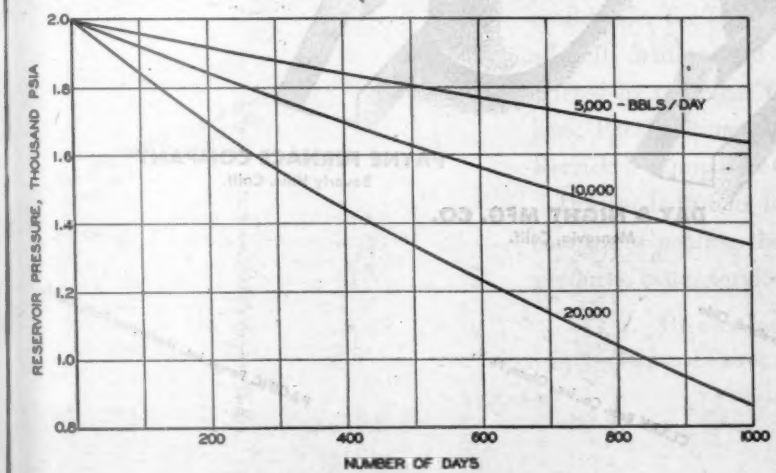


Fig. 27-5—Pressure vs. time and rate of oil production; gas-oil ratio equals 943. (See Example 3)

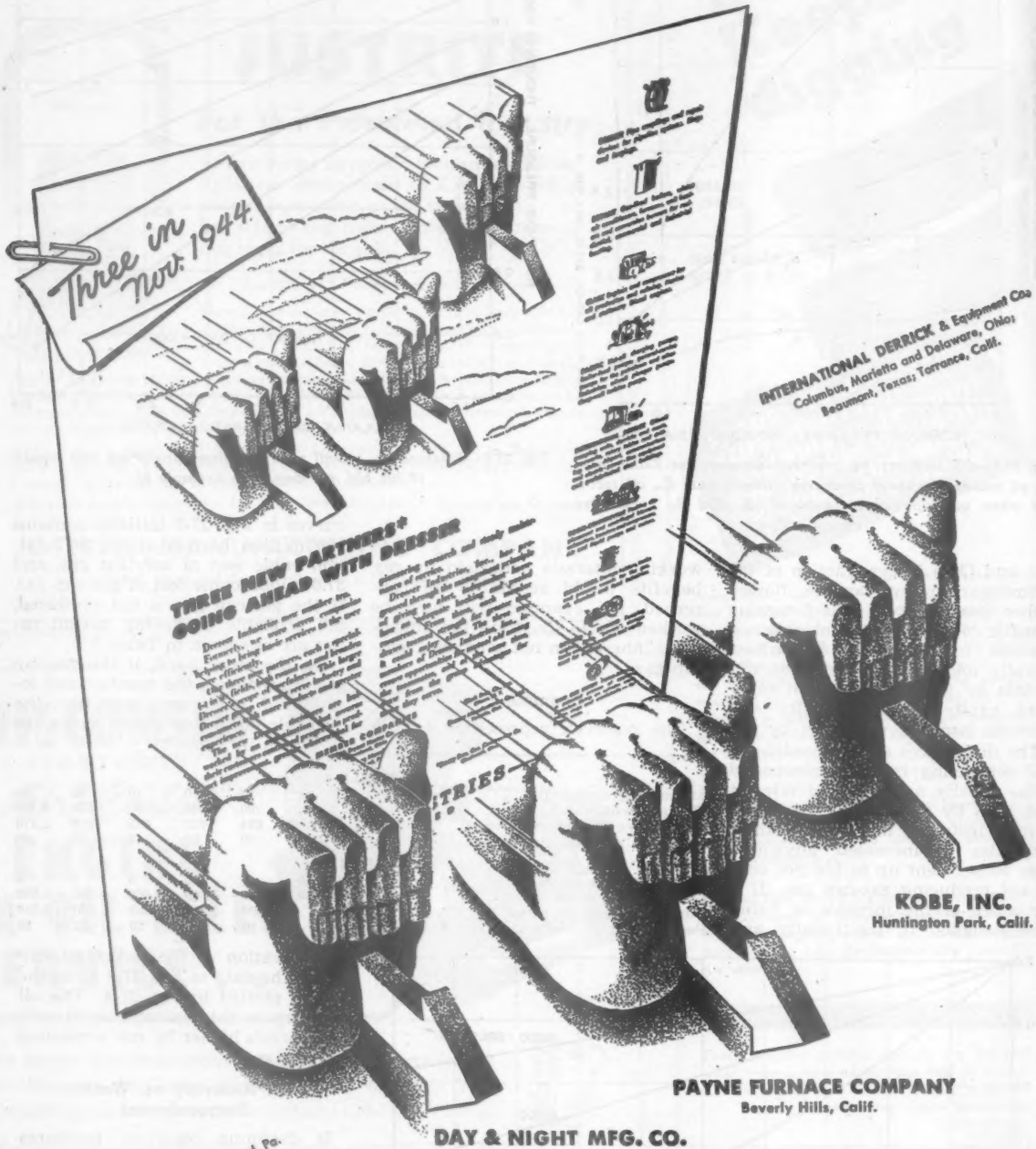
Application of the foregoing values to the data in Fig. 27-3 gives the results plotted in Fig. 27-4. The oil recovery in this example is 31 million barrels higher by not producing gas-cap gas.

Oil Recovery vs. Water Encroachment

If declining reservoir pressures are accompanied by encroachment of water, curves of the type shown in Fig. 27-3 are used to estimate (1) the oil recovery by expansion alone, (2) the oil recovery by water encroachment alone, and (3) the rate of water encroachment.

For reservoirs having a primary gas cap, the rate of water encroachment is defined by

$$W = \left(\frac{r - r_o}{r}\right)\frac{J}{J_1} \qquad (8)$$



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r = total per cent oil recovery

r_o = per cent oil recovery by expansion

$(r - r_o)$ = per cent oil recovery by water encroachment

An expression similar to Equation 8 was derived and illustrated by an example in the preceding article. As the procedure for applying Equation 8 is the same as that for Equation 12 in the preceding article, it need not be repeated.

The ability to predict future reservoir pressures for different rates of production is advantageous. This information can be obtained from curves of the type shown in Fig. 27-3. By way of illustration, two examples will now be considered. One for constant gas-oil ratio but variable rates of oil production. And one for constant rate of oil production but variable gas-oil ratios. The examples are for no water encroachment.

Example 3

The reservoir represented by the curves in Fig. 27-3 produced 5 million barrels of oil and 4.73 billion cubic feet of gas. The reservoir pressure declined from 2,500 psia. down to 2,000 psia. Estimate the future rates of pressure decline if oil were produced with a gas-oil ratio of 943 cu. ft./bbl. at the rate of 5, 10, and 20 thousand barrels per day respectively.

Solution: In this example, 5 million barrels of oil is 10 per cent recovery. Each addition million barrels of oil represents a 2 per cent increase in recovery. The number of days N required to produce a million barrels of oil equals $1,000,000/Q_o$ where Q_o is the oil-producing rate in bbl./day. The pressure is given by the 943 gas-oil ratio curve in Fig. 27-3. This pressure plotted against N the number of days gives the curves shown in Fig. 27-5.

Example 4

The reservoir represented by the curves in Fig. 27-3 produced 5 million barrels of oil and 4.73 billion cubic feet of gas. The reservoir pressure declined from 2,500 psia. down to 2,000 psia. Estimate the future rates of pressure decline if oil is produced at the rate of 10,000 bbl./day with variable gas-oil ratios.

Solution: In this example, 5 million barrels of oil is 10 per cent recovery. Each additional million barrels of oil represents a 2 per cent increase in recovery and requires 100 days to be produced. The pressure corresponding to a given cumulative gas-oil ratio and per cent oil recovery is obtained from the curves in Fig. 27-3. This pressure plotted against cumulative gas-oil ratios gives the data shown in Fig. 27-6.

The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Stripping Steam

STEAM is used to raise the flash point of most of the topping-plant products made from the side or bottom of the topping tower. The hot oil is contacted with the steam in a stripping tower which may be a packed tower (upper limit of diameter is 20 in.), a tower with six to ten side-to-side pans, or one with three to eight bubble plates. It is almost standard practice to use four bubble plates. Figs. 1 and 2 show approximate amounts of steam required to remove the "light ends" for the extreme cases of four and ten actual bubble plates (refer to Questions in Technology, March 2, 1944, p. 72). Fig. 3 is for only one plate or equilibrium contact, or for the blowing of steam through hot liquid without using a stripper. Such an operation is ineffective but is sometimes used because of its simplicity.

Flash point is related to the zero to 10 per cent distillation temperature somewhat as shown in Table 1.

Obviously this relationship varies depending on the kind of flash point, and the length of boiling-range of the stock. The relationship for kerosene will be given more completely in The Refiner's Notebook No. 59 entitled Kerosene Stripping.

TABLE 1

0 to 10% temperature	Flash point
100° F.	—36° F.
200	28
300	92
350	124
400	156
450	188
500	220
550	252
600	284
700	348
800	412

If the flash point or distillation curve of the unstripped material is available the tabulation and figures given here can be used directly but if such data are not available it is necessary to estimate the distillation curve of the unstripped material. Example—An unstripped kerosene has an I.B.P. of 200, a 5 per cent point of 310° F., and a 10 per cent point of 355° F., which is an average temperature of about 288° F. According to the tabulation its flash point would be about 90° F.

In order to obtain a flash point of 120° F. the 0 to 10 per cent distillation temperature (see tabulation) should be 344° F. Five or 6 per cent of material would need to be vaporized and this would require:

Steam lb./gal.	No. of plates
0.7	1
0.37	4
0.35	10

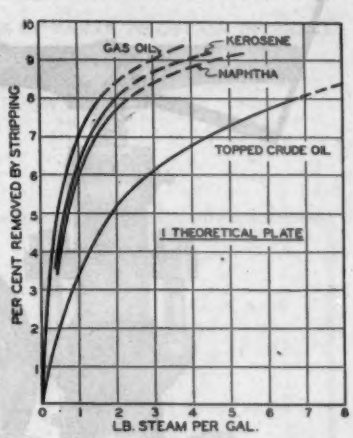

Fig. 3—Steam required (approximate) for stripping when using only a bath of liquid (one theoretical plate)

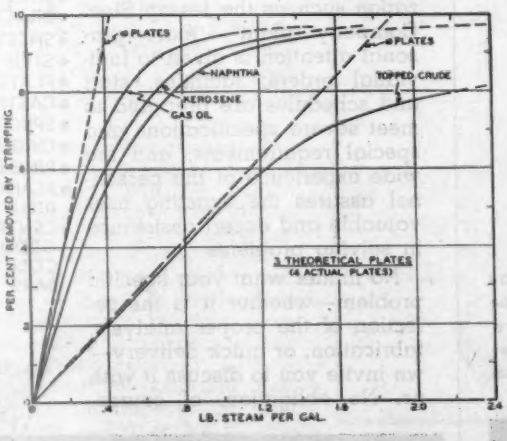

Fig. 1—Approximate steam required for stripping with four plates

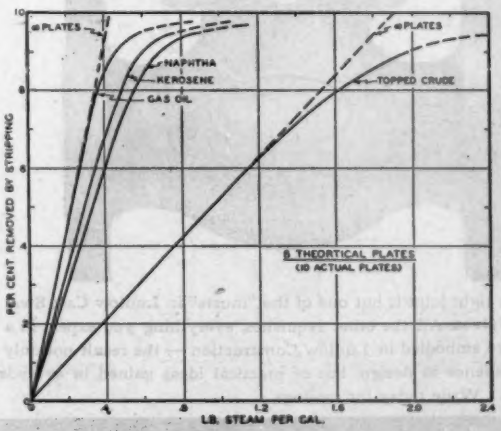

Fig. 2—Approximate steam required for stripping with 10 plates

No. 41 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

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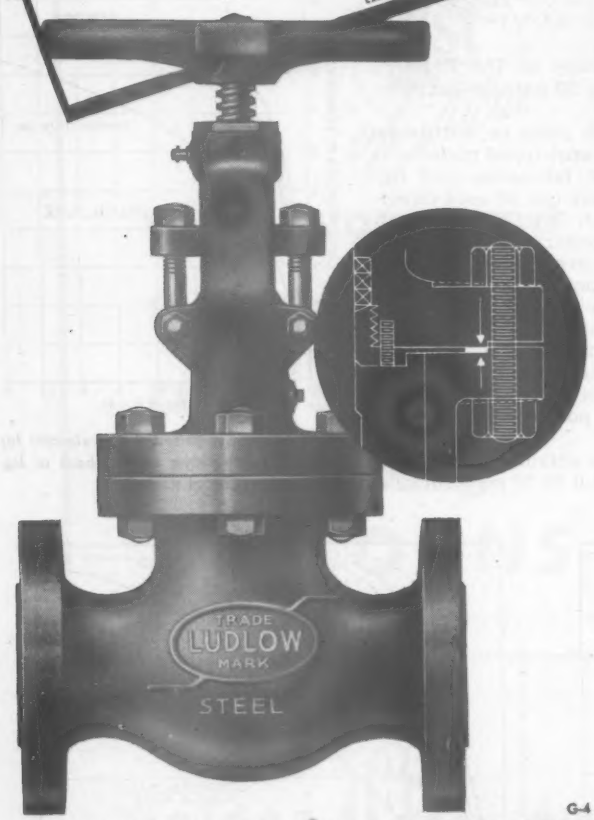

G-4

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Gaging Tanks and Measuring Rate of Flow of Oil Wells

Method of gaging oil.—The measuring of oil is an important feature of oil-field work. At present nearly 5 million barrels of crude oil are measured each day in the United States. Common procedure since the early days of oil production in Pennsylvania is to measure the outside diameter of oil tanks with a steel tape, calculate the inside diameter, measure the column of oil in the tank with a steel tape or gage stick, and then calculate the volume of oil in the tank from these measurements or read the volume directly from a previously prepared gage table. Gage tables are prepared for each tank showing the barrels of oil corresponding to each ⅛ or ¼ in. of depth. The work of gaging the oil is generally done by the switcher or pumper and the pipe-line gager. The work of calibrating the volume of the inside of the tank per fraction of an inch of height, called strapping the tank, and preparing the gage table, is the work of the field engineer.

The following equipment is used in measuring tanks: (1) 100 ft. tape, ¼ in. in width; (2) 500 ft. tape, ⅛ in. in width; (3) two sets of spring balances; (4) one pair of chain grips; (5) a set of poles; (6) ropes; (7) crayon; (8) height tape, graduated in feet, inches, and eighths of an inch; (9) plumb bob; (10) carpenter's level; (11) 5-ft. rule graduated in feet, inches, and eighths of an inch.

Method of strapping tanks.—It is important that the exact volume of the inside of a tank per fraction of an inch of height of the column of oil be measured accurately, because an error of only ⅛ in. in depth in a 55,000-bbl. tank means an error of 19 bbl. in gross volume of oil. Accuracy requires experience, skill, and technical ability.

The method generally followed is to measure or ascertain accurately the thickness of the tank. Then with a 100 or 500-ft. steel tape of certified accuracy measure the outside circumference of each section of the tank when the tank is full of oil. It is important that all circumferential measurements be made with the tape held at the same tension. This is accomplished by attaching a spring balanced to the end of the tape and bringing the tape to a standard tension at each measurement. Next, calculate the inside circumference from the outside measurement. This can be accomplished with fair accuracy by deducting 0.033 ft. for each 1/16 in. of thickness of the tank shell from the outer circumference expressed in feet. Deductions for common thicknesses of steel are given in the following table:

DEDUCTIONS FROM EXTERNAL DIAMETER OF TANKS TO OBTAIN INTERNAL DIAMETER FOR VARIOUS THICKNESSES OF TANKS

Tank thickness inches	Deductions inches	Tank thickness inches	Deductions inches
⅛	0.0653	¼	0.1310
5/32	0.0817	9/32	0.1473
3/16	0.0983	5/16	0.1637
7/32	0.1147	11/32	0.1800

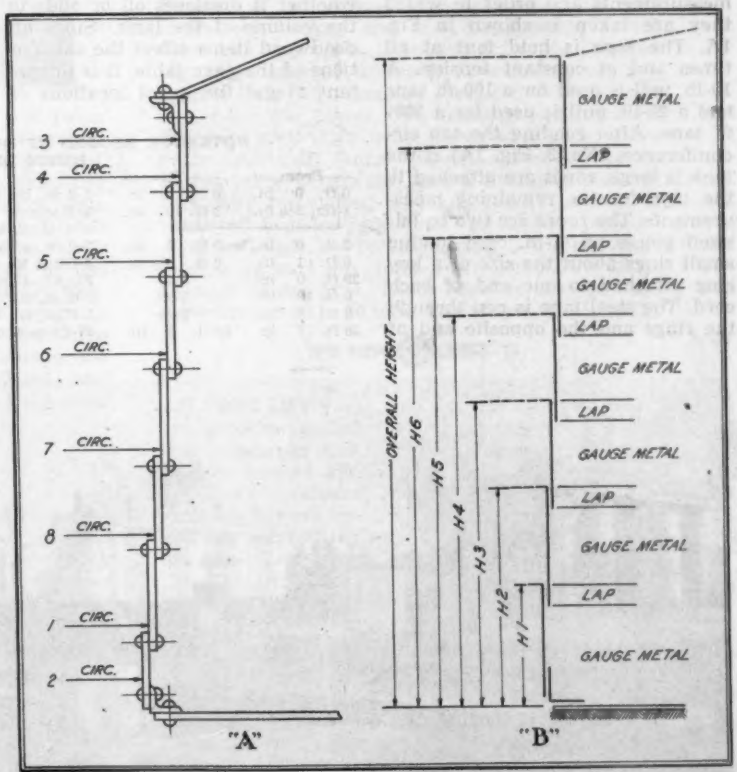


Fig. 1—A, Diagram showing points of measuring a vertical, steel-riveted type of tank. B, Position of vertical measurements of lap and section heights

Series prepared by F. B. Plummer, professor, petroleum engineering school, University of Texas

Engineering Fundamentals (Continued)

Finally, the area and exact position of any material which occupies space within the tank is measured and its volume calculuted. All material which displaces oil inside a tank is referred to as deadwood. In many places it is necessary to make accurate scale drawings of deadwood in order to calculate the volume of oil displaced per fraction of an inch of height above the bottom of the tank. Details of strapping vary with the type of tank to be measured. Six types of tanks are encountered in oil fields as follows: (1) Vertical, steel-riveted tanks; (2) vertical, steel-bolted tanks; (3) vertical, steel-riveted tanks with bulged or hemispherical ends; (4) prostrate, steel-riveted tanks with hemispherical ends; (5) vertical, galvanized tanks with straight sides; and (6) vertical, wooden stave tanks. These details can be most conveniently discussed separately.

Strapping vertical, steel-riveted type.—The position of the tape measurements and order in which they are taken is shown in Fig. 1A. The tape is held taut at all times and at constant tension. A 10-lb. pull is used for a 100-ft. tape and a 20-lb. pull is used for a 500-ft. tape. After reading the top circumference, (No. 3, Fig. 1A) if the tank is large, ropes are attached to the tape for the remaining measurements. The ropes are two equal-sized pieces of ¼-in. cord having small rings about the size of a key ring attached to one end of each cord. The steel tape is run through the rings and the opposite end of the cord held by persons standing on the top of the tank at positions such that the tape will be held taut at the exact position desired. As soon as the strapping of the circumferences is completed, the over-all height, height of rings, laps, and gage of the metal plates are measured as shown in Fig. 1B. The over-all height is measured near the gage hatch and at two other positions around the tank. It is a good practice to have a plumb-bob attached to one end of the tape used in measuring the height of the tank. If the bob is allowed to swing free, it is easy to determine whether or not the tank is vertical. The thickness of the gage plate may be measured with calipers, or the manufacturer's specifications for thicknesses may be used, if they are accurate.

Correcting for deadwood volume.—Deadwood is defined as any object in the tank which alters its normal capacity at any height. Deadwood is noted as a minus or plus volume depending upon whether it displaces oil or adds to the volume of the tank. Since all deadwood items affect the calculations of the gage table, it is important to get the exact locations of the bottom and top of all such objects in reference to the inside bottom of the tank. The size and length of all pipes, channels, plates, and lumber are measured, and their exact positions recorded. For example, a 4-in. by 4-in. by 10-in. block of wood lying lengthwise in the bottom of a tank should be recorded: One piece of wood from 0 ft.-0 in. to 0 ft.-4 in. and 4 in. by 4 in. by 10 in. long. If the block is in an upright position, then the record should read: One piece of wood 0 ft.-0 in. to 10 in. and 4 in. by 4 in. by 10 in. high. Pipes in a tank are recorded whether closed or open, and the volume calculations carried out according to the condition of the pipe. The accompanying record from a field notebook record shows clearly the method of recording deadwood measurements.

References

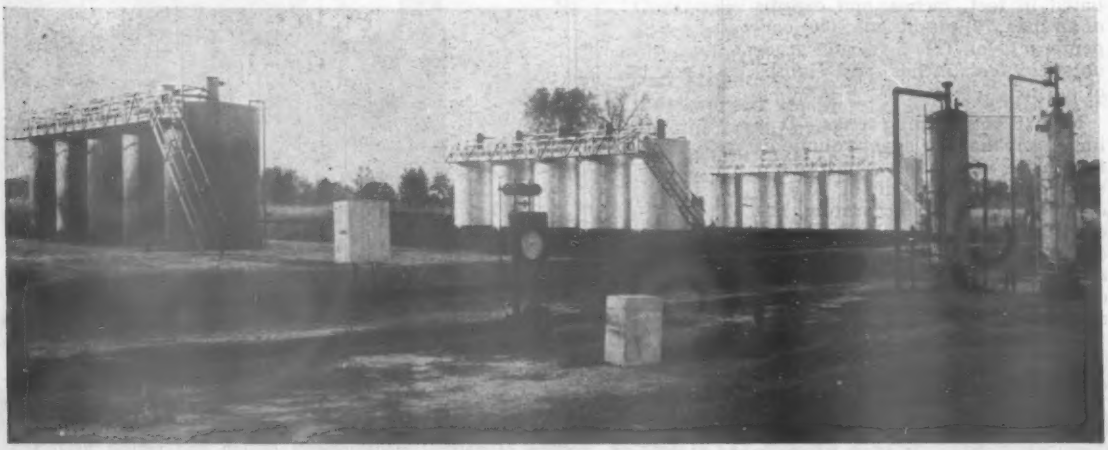
1. Am. Pet. Inst., A.P.I. Code for Measuring, Sampling, and Testing Crude Oil: Am. Pet. Inst. Code No. 25, pp. 1-43, January 1936.

2. Stallard, O. D., Jr., Measuring, Sampling and Testing Crude Oil: Oil Weekly, vol. 89, pp. 20-44, March 14, 1938.

3. Wilcox, E. H., Theory and Methods of Tank Gaging, Their Application to Routine Field Work: Oil Field Engineering, pp. 23-39, April 1928.

NOTEBOOK RECORD OF DEADWOOD MEASUREMENTS
MINUS DEADWOOD

From	To	
0 ft. 0 in.	0 ft. 3 in.	1-3 in. by 3 in. by ⅜ in. L by Circ.
1 ft. 2½ in.	3 ft. 10 in.	2-Manhole Rings—Outside Dia. 2 ft. 7½ in. by 1 ft. 9 in. by ⅝ in.
0 ft. 0 in.	0 ft. 9 in.	3-9 in./s/Ea 2 ft. 9 in. long
0 ft. 1 in.	0 ft. 8½ in.	4-Clips Ea 4 in. by 4 in. by ⅜ in. by 7½ in. long
29 ft. 0 in.	Top	27-/s/—Girders 6 in.
0 ft. 10 in.	Top	1-6 in./s/
0 ft. 1 in.	Top	1-7 in./s/
28 ft. 7 in.	29 ft. 0 in.	27-Clips 5 in. by 3 in. by ⅛ in. by 0 ft. 4 in.



This centralized gaging and storage operation handles several thousands of barrels of production per day. Two-stage separation is used. (McKamie pool, southern Arkansas)

OIL AND GAS EQUIPMENT Digest

IT'S NEW CHECK IT

by Kenneth B. Barnes

(1) FI-REPEL PAINT protects wood and other material against fire hazard. Endorsed by Underwriters' Laboratories and other leading testing bureaus for protection of all interior combustible surfaces, it is made for use wherever fire protection is necessary. Shipped as a concentrated paste, after dilution it can be applied with a brush or spray gun to the surface to be protected. One con-

centrated gallon, at standard dilution, will cover as much as 185 sq. ft. with two coats. Standard color is bone-white, but tints may be easily added. In a recent test made by the Portland, Ore., fire department, two identical wood structures were subjected to fires of burning oil. One, painted with Fi-Repel, suffered only minor charring, while the untreated one burned to the ground in less than 25 minutes. Illustration shows ordinary physician's tongue depressor, one end of which is painted with Fi-Repel. The unpainted end burns freely, but the flame dies when it reaches the painted portion. Available in 1-gal., 5-gal., and 55-gal. containers. *General Detroit Corp. and General Pacific Corp.*

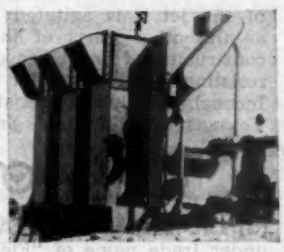
IT'S NEW CHECK IT

(2) HIGH-POWER HYDRAULIC PULLER is new development for reducing time and labor required for tough, heavy, pulling jobs. The Simplex-Jenny is a powerful hydraulic puller made with a center hole. Its action is identical to that of a hydraulic jack in that the ram is raised or pushed out by operating the pump. In the case of the Jenny, this ram is tubular. When a bolt or rod is inserted

through the ram and one end secured over the ram head, the rod is pulled in through the Jenny. Because of its center-hole construction, the unit is its own backup and is self-supporting at all times—an important time-saving feature. Weighing only one-half as much as conventional hydraulic jacks, the Jenny is ideal for field use and out-of-the-way places. One man can pull stubborn bushings, pistons, cylinder liners, wrist pins, valve seats (pictured), keys, wheels, sprockets, gears, boiler, tubes, pipes, etc. Also a lifting or pushing jack, and for rigging up as a press, the unit is made of heat-treated steels throughout. Alloy-steel pull rods are recommended as the unit will stretch or part any mild steel rod that will fit through center hole. There are five models, with capacities of 30 to 50 tons. *Templeton, Kenly & Co.*

IT'S NEW CHECK IT

(3) "GAS LIFT" evaporative cooler and condenser that can be hauled and set down wherever desired, is now operating successfully in the Kettleman Hills district. First one of its kind, the equipment has excited an unusual amount of favora-



The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

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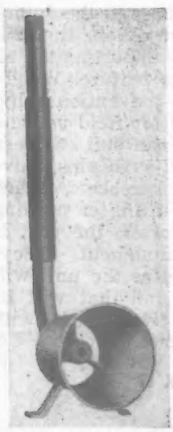
ble comment among oil operators of that area. Construction and installation costs of this unit were considerably less than those of a standard cooling tower of a similar capacity. The unit handles 15,000,000 cu. ft. per day of natural gas at 175° F., cooling it to 90° F. under 2,000 psi., and condensing out 160 bbl. of 42° A.P.I. oil. In addition, 15 bbl. per day of water are condensed, thus reducing probabilities of hydrate formation during reexpansion. Dimensions are 15 ft. long, 13 ft. high, 5 ft. wide, with weight approximately 7 tons. It can be operated with natural gas, gasoline, or electricity, and is completely self-contained. Temperature control is attained with motor-operated dampers which effectively maintain the desired gas-outlet temperatures, regardless of weather changes. Filtered air intake prevents accumulation of dust within, protects pump and spray unit, stops contamination of recirculating water supply, and increases life and efficiency of the entire mechanism. *Drayer & Hanson, Inc.*

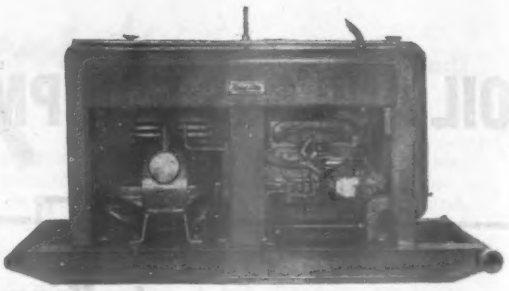
IT'S NEW CHECK IT

(4) NEW-TYPE JET utilizes steam, air, or liquid to thoroughly agitate and circulate liquids or mixtures in tanks and vessels. By installing the new Weldco jet in the corner or anywhere along the sides of a tank, tests show the entire tankful of liquid can be agitated and mixed at the same time. Easily installed by simply connecting it to an agitation-injection line, no special piping or additional lines are necessary. The velocity of the air, liquid, or steam increases as it passes through the special nozzle and expands into the bell-shaped housing of the jet. The action sucks the material from the tank through the back of the jet so that at the side and back of the jet it is agitated and circulated as well as the other parts of the tank. Entire unit is constructed of one piece of whichever corrosion-resisting metal is best for the installation—Monel, Inconel, nickel, stainless steel, or other materials. *Youngstown Welding & Engineering Co.*



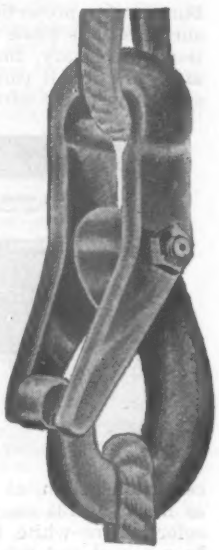
IT'S NEW CHECK IT

(5) OIL-FIELD LIGHT PLANT. A new unit offered under trade name of "Field-lite," is mounted on structural-steel welded base, with low center of gravity to prevent topheaviness. Center "U" channel with hook permits lifting by truck winch or gin pole when loading or unloading. Protected by heavy sheet-metal housing, with removable ventilated side panels. Fully enclosed engine-generator control panel. Automatic disconnect switch on overload or short circuit. Combination natural gas-gasoline carburetor. Furnished in 5 and 7½ kw. models. Ruggedly built. For drilling rigs, pipe lines and other oil-field service. *Buda Engine Sales & Service, Inc.*



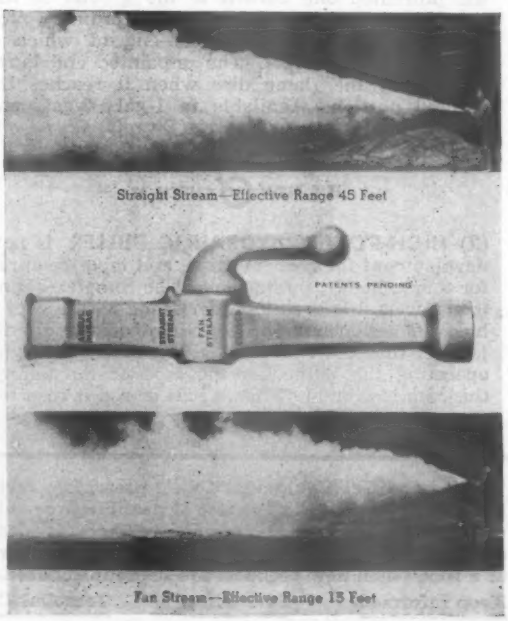
IT'S NEW CHECK IT

(6) SAFETY HOIST HOOK is constructed around a patented shoulder and lip which are designed to eliminate load slippage and hook straightening. On test, one of the No. 2 ACLC hooks, weighing only 9 lb. and rated at 10 tons, withstood without ill effects a Columbia University laboratory proof load test of 60,000 lb. The self-locking shoulders and lips of the hooks are designed to clear protuberance without snagging, keep hoist and load in true alignment. Priced less than ordinary hooks. *American Chain Ladder Co., Inc.*



IT'S NEW CHECK IT

(7) DUAL-STREAM NOZZLE is development which greatly increases effectiveness of wheeled fire-fighting equipment. The new nozzle permits



the operator to apply the dry chemical on a fire either as a long-range straight stream or as a shorter fan stream. After observing extensive large-scale fire tests on test grounds, Factory Mutual Laboratories have given the Dugas wheeled extinguisher greatly improved ratings. With this new dual-stream nozzle, overhead fires, heretofore considered exceedingly difficult to fight, can be extinguished successfully. Tests on overhead fires were just one of many kinds of large-scale fires which were quickly extinguished. *Dugas Division, Ansul Chemical Co.*

IT'S NEW CHECK IT

(8) INJECTION WELL SEPARATOR eliminates excessive compressor outlet pressure and blowing of injection wells to remove scale, sediment, carry-

over lubricating oil, etc., from the face of the formation. Type 4-C is built for 5,000-psi. service, with all models carrying built-in mist extractor. *Peerless Mfg. Co.*

IT'S NEW CHECK IT

(9) PORTABLE GRAVITY METER for geophysical exploration work is easily carried by one man instead of the usual three or four. A back pack is furnished to which the meter is fastened and carried comfortably. The gravity meter, weighing only 28 lb., is temperature compensated, and the current required for maintaining the temperature is sufficiently low that a single motorcycle battery will keep it unaffected by outside temperatures throughout the day. Weight of the entire unit, meter, back pack, and battery, is only 45 lb. This light-weight and easy portability makes it extremely versatile in field use. *North American Geophysical Co.*

IT'S NEW CHECK IT

OIL AND GAS EQUIPMENT Digest

IT'S NEW CHECK IT

TRADE LITERATURE

(10) CENCO NEWS CHATS, containing detailed and illustrated descriptions of latest apparatus developed for industrial laboratories. High-vacuum pumps, constant-temperature ovens, carbon determinators, oscilloscopes, are among the many instruments described. *Central Scientific Co.*

IT'S NEW CHECK IT

(11) OIL MUST BE DISCOVERED. An attractive booklet describing, in the layman's language, how oil is found with the modern seismograph; what goes into making up an effciient crew; responsibilities of each member; and the future opportunities for geophysics. *Seismograph Service Corp.*

IT'S NEW CHECK IT

(12) NEWSFRONT, a new monthly publication by Westinghouse, printed in two-colors, illustrated with drawings and photographs. Will contain short articles describing the latest achievements by the company in the fields of scientific research, engineering and production. Those who request will be placed on mailing list to receive "Newsfront." *Westinghouse Manufacturing Co.*

IT'S NEW CHECK IT

(13) HEAT INSULATION HANDBOOK. Over 300 pages of engineering data, drawings, specifications, applications, etc., on heat insulation. Very complete, containing many useful data. *Ehret Magnesia Manufacturing Co.*

IT'S NEW CHECK IT

(14) FLO-WATCH INSTRUMENTS. Bulletin available describing the various types of precision instruments that render aid in the efficient distribution and use of liquids, steam, air or gas. Measures the flow through standard differential producers such as venturi tubes, nozzles, and orifices. Fully illustrated for both mechanism and operation. *Builders-Providence, Inc.*

IT'S NEW CHECK IT

(15) GASKETS AND PACKING. A set of bulletins available dealing with Corrosion Resistance of Gaskets, the principle of gasketed closures, gasket materials (fully illustrated in wall-chart form), and a guide to gasket selection with consideration to the factors of (1) bolt load, (2) hydrostatic end force, and (3) internal pressure. *Goetze Gasket & Packing Co., Inc.*

IT'S NEW CHECK IT

(16) PIPE-LINE PROTECTION. A folder available describing service available for pipe cleaning, coating, wrapping and storage. Service available in the field, on plant or railhead jobs. *Pipe Line Service Corp.*

IT'S NEW CHECK IT

(17) WINCHES. A catalog on full line of winches and power takeoffs is offered, containing detailed cutaway drawings, photographs, specifications, and integral parts. *Tulsa Winch Manufacturing Corp.*

IT'S NEW ✓ CHECK IT

(18) TUBE-CLEANING PROCEDURE. A bulletin on correct steps to be taken before, during and after a tube-cleaning operation to insure highest efficiency. Supplied in the form of a step-by-step check list. Covers selection of appropriate equipment, proper cleaning procedure, care of equipment, and lists types and sizes of motors, cutters, brushes and other accessories. Well illustrated. *Thomas C. Wilson, Inc.*

IT'S NEW ✓ CHECK IT

(19) HEAT-TRANSFER EQUIPMENT. A detailed catalog, well illustrated, and containing detailed specifications. Includes design formulas, construction details, tube layout tables, metallurgy, heat exchangers for pilot plants, and the design of evaporators and freezing systems. *Downington Iron Works.*

IT'S NEW ✓ CHECK IT

(20) CHAIN BELTS made of Rex Z-metal are described in folder containing interesting and practical information. One of the factors claimed for this type casting is its resistance to corrosion due to patented process of manufacture. *Chain Belt Co.*

IT'S NEW ✓ CHECK IT

(21) HEATERS AND COOLERS. A new 12-page two-color bulletin describing three types of heaters and coolers, including dimensions, capacity tables, and prices, on units suitable for use as instantaneous heaters, condensate coolers, preheaters, fuel-oil heaters, etc. *American District Steam Co.*

IT'S NEW ✓ CHECK IT

(22) UNIVERSAL JOINTS. A bulletin for design engineers describing both machined type and forged type universal joints. Illustrated specification tables and construction data included. Built for hard outdoor service, and extensively used in heavy-duty oil-field-trucking service. Provides a sturdy flexible drive between the power takeoff and discharge pump, or dump hoist mechanism. *Holloway Engineering Co.*

IT'S NEW ✓ CHECK IT

MEN IN THE NEWS

Carl L. Zak has been made assistant general manager of sales, and **E. R. Smith,** manager of oil-country tubular sales, of Pittsburgh Steel Co., Pittsburgh, Pa.

Lucien W. Moore has been appointed general manager of sales and branch houses for Crane Co., Chicago, Ill., succeeding **J. A. Dwyer,** recently elected vice president in charge of sales and branch houses. **F. J. Wilkey,** district manager, Chicago, is manager of the valve and fitting department, position occupied by Moore until his recent assignment in France by the War Department.

William L. Mariwick, Lee A. Swem and **Charles E. McCulloch** have been elected directors of Foster Wheeler Corp.

J. F. Tucker has supervision of the warehouse of Wilson Supply Co., which has recently been moved from Gladewater to Kilgore, Tex.

John S. King has been appointed manager of the pump division of Fairbanks, Morse & Co., Chicago, Ill. Previously he was manager of the firm's New Orleans branch.

Dr. Charles Allen Thomas, director of Monsanto Chemical Co.'s central research laboratories at Dayton, Ohio, has been elected vice president of the company. Effective September 1, he will become a member of the executive committee.

W. W. Runkle, who since 1928 has been in charge of sales of Hazard Wire Rope Division of American Chain & Cable Co. for the Mid-Continent area, with headquarters in Fort Worth, Tex., has recently been transferred to Pittsburgh, Pa. In his new position, in addition to being district manager of Hazard, he will be in charge of both wire rope divisions of American Chain & Cable Co. in Western Pennsylvania, Ohio, Kentucky, and West Virginia.

C. A. Independent Petroleum Supply, Apartado 931, Caracas, Venezuela, has been formed to devote its activities to spot delivery and servicing of geophysical and certain oil-field supplies. **P. Delfino** is manager.

S. B. Heppenstall, Jr., has been elected vice president of H. K. Porter Co., Inc., Pittsburgh, Pa. Formerly he was vice president in charge of sales of the Heppenstall Co. The company also announces appointment of **J. C. Hamilton** as service engineer for Quimby pumps and Fort Pitt steel castings in Chicago and surrounding territories.

H. Lester Freeman has been appointed Washington representative for the export division of Oil Well Supply Co., U. S. Steel subsidiary, according to **Fred F. Murray,** company president. Since 1942 he has been with PAW as materials specialist.

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REFINING

Aluminum Chloride Produces 80-Octane Fuel

Production of gasoline of 80 octane rating with good tetraethyl lead susceptibility through cracking petroleum fractions in the presence of aluminum chloride is reported from experiments made by V. I. Komarewsky and Lee Warson of the Illinois Institute of Technology, Chicago, Ill. Results are reported in Industrial and Engineering Chemistry, American Chemical Society publication.

A cracking process for gasoline from petroleum using anhydrous aluminum chloride as a catalyst was developed in 1915 by A. M. McAfee, but it did not find wide application, they explained. They restudied this method, using modern analysis techniques and fractional distillation, since it offered a product containing a large amount of low-molecular isoparaffins, and should possess a high antiknock value and good TEL. susceptibility.

Pennsylvania, California, and Trinidad gas oils, and Trinidad and Michigan naphthas were used as charging stocks, and the catalysts were anhydrous aluminum chloride and hydrogen chloride.

"The cracking of straight-run gas oils and naphthas in the presence of aluminum chloride results in the production of gaseous and liquid hydrocarbons completely free from olefins," they reported. "This fact differentiates these products from those obtained in thermal or catalytic cracking.

"The gaseous products contain large amounts of isobutane, 30 per cent by volume of charge. The liquid product boils entirely in the aviation gasoline range (end point 150° C.) and consists mainly of paraffin hydrocarbons, 83-95 per cent, as revealed by fractionation and hydrocarbon group analysis. The similarity of the results obtained from charging stocks of various origin, such as Pennsylvania, California and Trinidad gas oils, indicates the similarity of the reactions taking place during aluminum chloride cracking.

"A longer reacting time increased the formation of low-boiling paraffins and improved the octane number of the gasoline produced. This is particularly clear in the experiments with Pennsylvania gas oil. By increasing the reacting time from 5 to 15 hours, the yields of propane, isobutane, isopentane, and aviation gasoline increased from 2 to 13.8 per cent, 5.8 to 34.0 per cent, 3.9 to 21.1 per cent, and 13.1 to 47.5 per cent, respectively, with consequent increase of the octane value of aviation fraction from 53.5 to 82."

New Neoprene Unit Raises Production 26 Per Cent

LOUISVILLE.—A new unit has been completed at the Du Pont neoprene plant, enabling the company to increase the output of this high-priority synthetic rubber 26 per cent, to an annual volume of 60,000 tons. The addition to the government-owned plant cost $7,000,000 and is the fifth in a series rushed to completion to meet the demand for neoprene.

Because of its resistance to sunlight, neoprene is specified in the balloons that carry aloft the radio antenna on life rafts. The balloons will remain aloft 10 days, as compared to less than 1 day for natural rubber. Meteorological balloons are also made of neoprene.

Among other military uses are the life rafts themselves, 10-man invasion boats, immersion suits to protect shipwrecked men or downed fliers from the killing exposure to cold water, jacketing for field telephone lines and ship cable, fuel and hydraulic hose, and carburetor diaphragms for airplane and other engines. Gaskets which seal the doors of the B-29's pressurized cabins are

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DROP FORGED STEEL LIQUID LEVEL GAGES
Used to observe color and density of liquids under high pressures and/or temperatures. Construction exceptionally sturdy. Made of alloy temperature resisting steel, and are highest quality throughout. Liquid chamber made from solid block of steel to assure perfect alignment and rigidity. Conform with A.P.I.—A.S.M.E. requirements.
The "Transparent" is one of the complete line of Penberthy gages that meet every liquid level gage requirement.
PENBERTHY INJECTOR CO.
DETROIT, MICH.
Canadian Plant WINDSOR, ONTARIO

IT'S NEW — THE HOLAN 2-TON WINCH

Front view of Holan 2-ton Winch

The Latest Development In Compact, Easily Operated Winches — Tops In Quality

Small and compact, this winch is exceptionally easy to operate and very efficient. Two speed ratios permit handling heavy loads at slow speeds and light loads at high speeds. Perfect control is assured for raising load. When lowering load, control is secured by a single shoe hand brake that has sufficient capacity to hold full load. Full rated load is 4000 lbs., but each winch is tested at factory by applying a load of approximately 6000 lbs.

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of neoprene. Here its resistance to oils and to aging are of particular importance.

Directive Issued to Assure Navy Supplies

CHICAGO. — District 2 refineries this week started operating under a Petroleum Administration for War directive to supply specified volumes of Grade 7-0-2-D diesel fuel and Pool 21 distillate fuel oil. The directive replaced a voluntary plan and probably is designed as much for protection of the supplying companies as for assuring results.

The order applies to production of both 7-0-2-D diesel oil and Pool 21 gas oil. It gives to each refiner an order to deliver a specific amount for the month of May. Actually, the requirement is expected to continue indefinitely.

It is stated the manufacture of the material is not to be allowed to interfere with maximum manufacture of critical petroleum war products

The order, however, does not embrace the entire program, since it does not provide for replacement stock from others for that portion of the oils covered by directive in excess of the pro rata share.

A letter has been dispatched to all refiners from PAW on this phase which states that:

"The emergency of the supply situation for military diesel fuels requires that the total indicated manufacturing potential be utilized at once; this will make available to the military on May 1 sufficient material to supply demand . . . The fact that you have not received advice regarding amount and source of replacement material due you should not be cause for alarm.

"It is necessary that an estimate of distillate production in District 2 by plants for May be available before any replacement schedules can be developed. This information is being obtained by air mail and should be at hand next week (this week). Steps will be taken immediately to determine pro rata shares and replacement movements. It is expected such will be complete by May 5 when directives will be issued to effect delivery of any replacement oils due you."

It appears to be generally agreed that on the basis of present operations the meeting of the military distillate requirement will cause a shortage of distillate for the district.

In overcoming this shortage the proposed recommendation is that any company desiring the help of PAW up to the amount of that company's average pro rata share of its contribution to the military distillate requirement shall be entitled to aid.

The plan contemplates assistance from PAW in bringing buyer and seller together on replacements, or in halting shipments from the district to the East Coast, etc., but it does not involve any special arrangements such as compensatory transportation.

Parkhurst and Jayne Promoted by Davies

WASHINGTON. — Promotions of George L. Parkhurst, of Chicago, to Contract Executive of the Refining Division of the Petroleum Administration for War, and of F. M. Jayne, of Berkeley, Calif., to assistant division director in charge of economics and facilities, were announced last week by Ralph K. Davies, deputy petroleum administrator.

Parkhurst's office is newly created. He had been assistant director of the refining division. Jayne had been chief of the economics section of the division.

When the United States entered the war it was necessary to build 100-octane aviation gasoline refineries—a $1,000,000,000 undertaking. Parkhurst assisted in arranging for Federal assistance and supervised all the contract negotiations for both federally and privately-owned refineries. He formulated the contract that is now accepted between the refiners and federal Government agencies in the sale of products to the latter.

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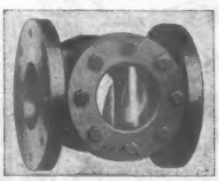

Bulletin 43A covers the complete line.

HENRY E. JACOBY, M. E.
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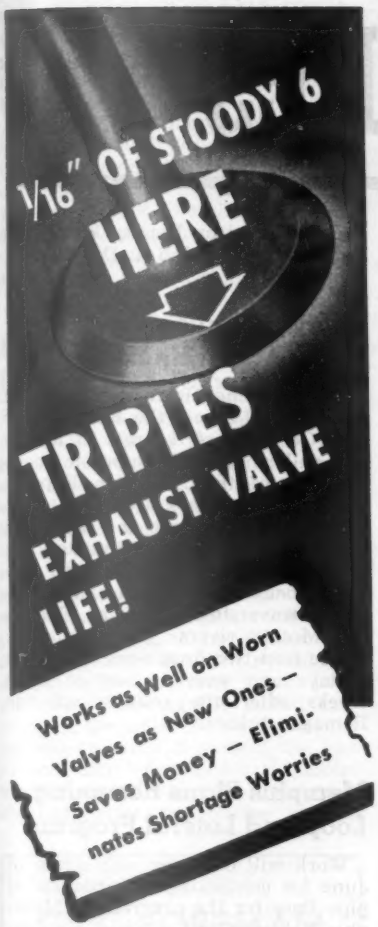
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EXHAUST VALVE
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AN ounce or two of Stoody 6 welded to new or worn exhaust valve faces adds 300 to 400 percent to their normal life, prevents burning, saves overhaul jobs, costs only a few cents per valve.

This folder outlines the simple procedure any garage or shop equipped with acetylene welding equipment can follow. Eliminates your worries about valve replacements and saves money as well.

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How America's foremost pipe protection specialists can serve you better with the most complete and modern facilities available is told in the bulletin illustrated here.

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General Offices and Plant—
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PIPE LINES

Products Reach China Through Army Line

Oil and gasoline are flowing into China from Calcutta, India, through the world's longest pipe line, U. S. Army authorities have announced.

The last 400-mile link has been laid into China from northern Burma and no longer must China's war machine wait for fuel trucked or flown over mountain and jungle.

Army engineers, experienced in pipe-line construction in Southwest areas of the United States, with the aid of trained American soldiers and Chinese workmen, overcame difficulties at mountain passes 9,000 ft. above sea level, and in Burma jungles.

They toiled through the monsoons and freezing weather, solving engineering problems unheard of anywhere else in the world.

The pipe line is of both standard and portable types of construction. Army engineers estimate it can carry double the amount of fuel that could be trucked over the Stilwell road.

Its completion into China means that much of the traffic both over the Stilwell road and by air can be devoted to other vital war supplies.

Its completion means that the 14th air force in China can be vastly expanded. Formerly the amount of fuel available limited the number of planes in action.

In general, the line follows the Stilwell highway. The new system is able to pump 80-octane gasoline, 100-octane aviation gasoline and diesel oil.

Chinese and American troops guard the line to make certain it is not cut.

Committee Approves Extension of Cole Act

WASHINGTON, D. C.—Extension of the Cole Pipe Line Act to June 30, 1947, has been approved by the Committee on Interstate and Foreign Commerce of the House of Representatives.

The act permits the President to declare a pipe-line project essential to national defense and to grant power of eminent domain to companies undertaking designated projects. If no private companies can build a needed pipe line the act permits the Government to build such a project. Extension of the act was recommended by Deputy Petroleum Administrator Ralph K. Davies.

Army Operates Six Lines Across Rhine

Six pipe lines, in four groups, are pumping oil across the Rhine River into Germany at the rate of 3 million gallons daily, the supreme headquarters of the American Expeditionary forces announced.

Each is a 6-in. pipe and five lines already have been tied into the existing pipe-line system, which extends back into France and Belgium, traversing the Seine, Marne and Moselle rivers.

The first two lines were strung in 5 days and were in service in 2 weeks after the collapse of the Remagen bridge.

Memphis Plans Resuming Loop and Lateral Program

Work will be under way again in June for continuing construction of pipe lines for the program of Memphis Natural Gas Co. which was interrupted by a petition by two Louisiana state agencies which has been denied recently by the U. S. Fifth Circuit Court of Appeals.

Construction will be resumed near Robinson, Miss., for the laying of 61 miles of 18-in. in three loops; two in Mississippi and one in Arkansas along the main line. Before stoppage of the project, 8 miles of 8-in. had been laid. After completion of loops, the building of 50 miles of 20-in. will begin, probably some time in August, for a lateral from Lisbon to Monroe, La. The project has been contracted by N. A. Saigh Co. which is renting construction equipment from Anderson Brothers Construction Co. for the job, according to reports.

Sinclair Plans for Steubenville-Toledo Line

Plans are being made by Sinclair Refining Co. for building a new 8-in. pipe line from Toledo to Columbus and Steubenville, Ohio, at a cost of $4,000,000, according to reports.

The line would be a carrier for gasoline and other refined petroleum products.

At Steubenville a terminal and

bulk station is planned from which it will be possible to receive or dispatch petroleum products by water in conjunction with the operation of the pipe line.

The new pipe-line project will tie in at Toledo with either lake or pipeline movement. Sinclair last year completed a pipe line from Chicago to Toledo at a cost of more than $5,000,000, and purchased the old Craig oil site in East Toledo for bulk storage and as a marine terminal.

Bureau of Standards Studies Zinc Anodes

In order to study the effectiveness of zinc anodes for the cathodic protection of iron and steel under various soil conditions, zinc-iron couples were buried at eight test sites under the bureau's auspices in 1941, according to Technical News Bulletin, issued by National Bureau of Standards. Measurements of the current and potential were made on the couples at the time of installation and at subsequent inspection periods. In general, the currents have been maintained during the period covered by the tests. At two sites, the current required to protect the iron cathodically was measured. Couples were removed from two sites and cleaned, after which the loss in weight of each element was determined. Coupling to zinc reduced somewhat the corrosition of the iron for 1.5 years in a soil containing sodium carbonate, but the degree of protection cannot be considered adequate. At the other site the iron was almost completely protected galvanically during the exposure period of 3.14 years.

The complete report on this work, by Melvin Romanoff, will be published in the Proceedings of the National Association of Corrosion Engineers.

Canadian Firm Plans For 80-Mile Gas Line

Community Services Ltd., Saskatoon, Sask., is considering plans for the construction this summer of a 6-in. i.d. natural gas pipe line to extend approximately 80 miles from the Lloydminster field to North Battleford, Sask. The company has indicated that it is seeking information from companies in the natural gas industry regarding procurement of materials and equipment to facilitate construction of this line and the distribution system.

Everett-Waltham Line Moves Refined Products

Colonial Beacon Oil Co. has commenced operation of the 6-in. products line from Everett to Waltham, Mass., for distribution to serve cities and towns in the vicinity of Waltham. The 4-in. line from Waltham to Dracut, Mass., continues to be in the process of construction. The entire project is scheduled for completion in July.

The City of Lawrence has appealed to the State Supreme Court of Massachusetts in connection with a permit granted to cross the Merrimack River from a point near Dracut. The case may not be heard until the fall session of the court.

Products Pipe Line Shipments Increase

Pipe line transportation of motor fuel in February exceeded that in February, 1944, but was below transportation in the 31-day month of January, 1945. Meanwhile, movement of motor fuel in pipe lines in the first 2 months of the year also registered substantial gains from the same 1944 period.

Motor fuel turned into pipe lines in February was 24,075,000 bbl., an increase of 31 per cent from the February, 1944, total of 18,408,000 bbl., but was 11 per cent below the January total of 27,082,000 bbl.

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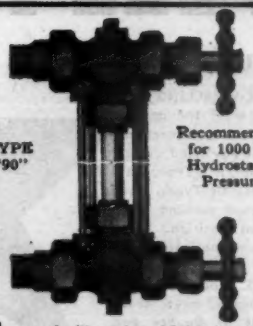
DROP FORGED STEEL
LIQUID LEVEL GAGES



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BUCKEYE MODEL 11 for Speed and Economy on gathering, product and natural gas lines. Digs trench 11½" to 22" wide — up to 5' deep.

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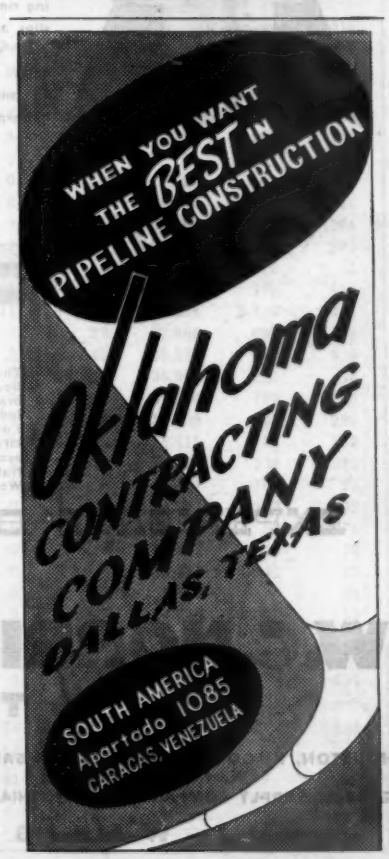

5 STAR WELL HEAD EQUIPMENT

STUFFING BOXES

Norris FREE-WHEELING Stuffing Boxes meet the demand for low priced and economical units of advanced design Available in "T" Type, Regular and Flexible Types. Hand wheel permits packing take-up from any position. Large oil reservoir lubricates polished rod under pressure, NORRIS "S" and "C" Type Stuffing Boxes meet every requirement of Quality and low initial cost

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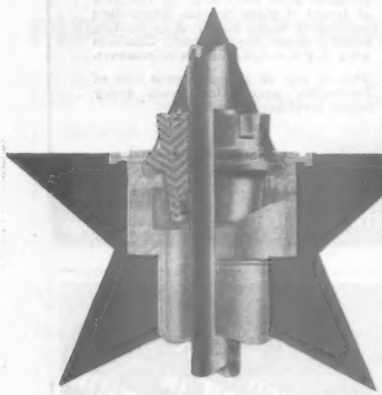
Available in SWAGED TY... ...split glands, made ... ...a-heavy steel pipe, ...steel glands and steel ... ing rings.

Norris Braden Heads are al... available in Semi-Steel ... 2,000 pound test pressu... and Cast Steel for 4,0... pound test pressure.



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Supplies the need for a stronger and safe means of ...porting and packing the ...ubing strings Extra long self-aligning slips won't cut or pinch tubing strings. Packing ring located at bottom of slips assures maximum tight seat without unnecessary parts or adjustments. Will fit any Standard or Berry Pattern Casing Head.

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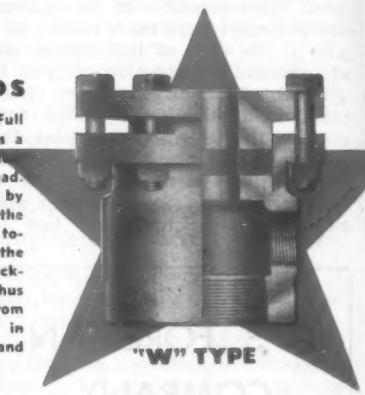
The Norris Type "W" Full Opening Tubing Head fills a long felt need for a practi... yet inexpensive tubing head. The tubing is supported by the collar resting on the gland. Weight of tubing, together with tightening of the bolts forces the rubber packing against tubing wall, thus shutting off pressure from ...ithin. Also available in ...ght and Regular Types and ... Type Tubing Head.



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The Fully ...ustable Non-Chattering ...RRIS Flow Bean is e... installed and serviced. Acc... Calibrated, M...rometer Type Dial, sychronized wi... edle, indicates Equivalent positive orifice size. Controls the flow of fluid or gas, also providing a means of regulating the pressure and rate of flow with extreme accuracy. 1,000-Pound Working Pressure type illustrated, also available for lighter service of 300-Pound Working Pressure.

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BUY WAR BONDS FOR VICTORY

Exploration and Drilling

Week's Highlights

A NEW deep pool has been opened in Grady County, Oklahoma, along the south rim of the Anadarko basin, by Magnolia Petroleum Co. 1 Cunningham, SE SE 33-5n-6w, between the Knox and Cement pools. With a surface elevation of 1,152 ft., the Cunningham is producing from perforations in 2½-in. tubing at 10,879-82 ft.

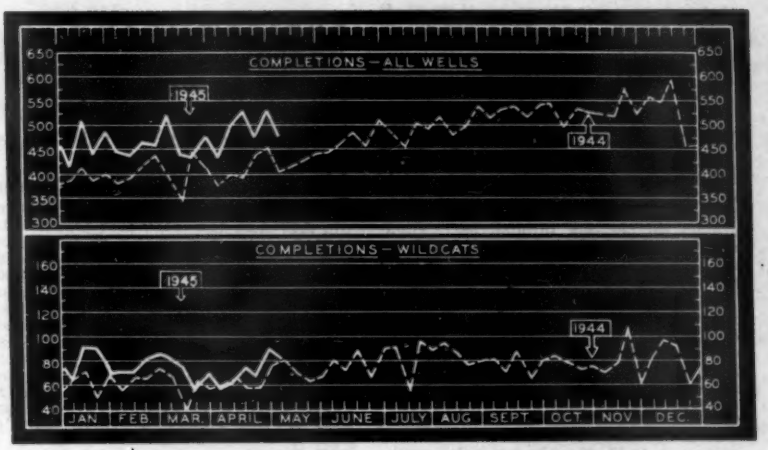
Three production tests have been made. On the first, in 20 hours, the well flowed 243 bbl. of 54-gravity condensate with a substantial amount of gas. On the second test, in 24 hours, it flowed 317 bbl. of condensate with 6,000,000 cu. ft. of gas; and on a third test, before shutting in for lack of storage, it flowed 147 bbl. of condensate with 2,180,000 cu. ft. of gas, through various sized chokes. Casing pressure was reported 3,029 lb., tubing pressure 2,600 lb., and separator pressure 705 lb.

Electric log data are reported to indicate even more favorable "kicks" up the hole in limey sand at 10,345-77 ft., in sands at 10,381-10,429 ft., 10,466-74 ft., and at 10,514-63 ft., with the present producing horizon showing a "kick" at 10,872-78 ft.

The producing horizon is being called a sand in the Springer formation of the lower Pennsylvanian, with the top of the Hoxbar called at 6,110 ft. A few geologists, figuring the section from Hoxbar to Springer should be thicker, are inclined to doubt the Springer classification until they have more data on sample checking. These geologists are inclined to think that Deese would sound more reasonable for the interval than Springer.

The axis of the regional surface structure trend in this general area lies about 2 miles south of the Cunningham well. At Cement, the best deep production lies south of the axis of the surface structure, or just the opposite of the apparent situation at the new discovery. This may mean that the present structure shifts substantially with depth, or that the production is coming from a sand that does not go over the top.

The new discovery lies along a trend which has been highly regarded since the early 1920's, when surface signs of a regional fold were found along the south rim of the Anadarko basin.



Solid line charts current weekly completions, service wells in Eastern area included

COMPLETIONS IN ALL FIELDS . . .

Week ended May 5, 1945

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1945	1944
New York	13	0	*13	26	33,800	409	316
Pennsylvania	36	4	†32	72	111,225	1,233	634
West Virginia	2	18	3	23	51,364	267	159
Ohio	4	5	6	15	39,932	259	308
Indiana	0	0	0	0	0	51	79
Kentucky	5	0	4	9	11,320	118	208
Illinois	15	0	8	23	66,204	510	541
Michigan	5	3	7	15	35,324	244	184
Kansas	8	7	15	30	101,782	511	579
Nebraska, Missouri, Iowa	0	0	0	0	0	12	13
Oklahoma	20	2	17	39	167,246	778	524
Texas:	76	11	50	137	677,986	2,434	1,712
North Central	15	1	13	29	77,600	689	488
West	30	0	15	45	236,030	647	516
Panhandle	5	3	2	10	36,927	201	58
Eastern	4	2	1	7	47,114	108	105
Gulf Coast	17	4	13	34	224,900	563	289
Southwest	5	1	6	12	55,415	226	258
Louisiana:	6	0	5	11	84,464	319	231
Northern	2	0	2	4	13,117	102	92
Southern	4	0	3	7	71,347	217	139
Arkansas	3	0	0	3	12,581	50	74
Mississippi	6	0	5	11	82,073	116	39
Southeastern States	1	0	0	1	2,712	12	11
Montana	3	0	2	5	9,944	100	81
Wyoming	2	0	2	4	14,859	72	51
Colorado-Utah	1	0	0	1	6,461	12	11
New Mexico	4	1	2	7	28,399	171	133
California	32	3	6	41	173,631	795	651
Total United States	242	54	177	473	1,691,307	8,474	6,539
Total previous week	271	56	200	527			
Total May 6, 1944	203	32	128	363			

Service wells included: *13, †30.

SOUTH LOUISIANA

Venice Field Gets Deepest Production

NEW ORLEANS.—Tide Water Associated Oil Co. 1-C Manhattan Land & Fruit CO., 23-21s-30e, at Venice field in Plaquemines Parish, new sand, flowed a potential of 253 bbl. daily through 5/32-in. choke from perforations at 11,857-98 ft. Tubing pressure was 1,250 lb., gravity 35°, gas-oil ratio 740 to 1. Total depth is 12,431 ft., with 5½-in. casing set at 12,424 ft. This is the deepest production yet found in this prolific oil field.

Humble Oil & Refining Co. 4-B Petit Anse Co., Inc., 23-13s-5e, at Avery Island field in Iberia Parish, is reperforating at 9,219-22 ft., after plugging back and making squeeze job at 8,750-53 ft. Total depth is 11,405 ft. with 5½-in. set at 11,289 ft. It had shown a flow of 44 bbl. of 44.6° gravity oil per day through perforations at 11,208-16 ft., in a new sand for the field, tubing pressure 2,400 lb., gas-oil ratio 27,425 to 1.

Continental Oil Co. 1 J. W. Baggett, 9-11s-9w, at East Moss Lake field in Calcasieu Parish, gaged 205 bbl. of condensate daily through 11/64-in. choke from perforations in the 10,400-ft. sand, tubing pressure 6,100 lb. shut in and 2,800 lb. flowing. Gas-oil ratio is 15,285 to 1, and the total depth is 10,521 ft.

C. I. Production Co. 1 Octave Aucoin, wildcat in 56-17s-19e, about 2 miles northwest of the Lake field in LaFourche Parish, ran log to total depth 10,500 ft. and is dry. It ran about 200 ft. low to field producers, topped the "A" sand, which carried salt water, at 9,687 ft.

Fifteen Oil Co. 7 South Coast Corp., 43-14s-10e, at Charenton field in St. Mary Parish, flowed at the rate of 220 bbl. pipe-line oil daily through 9/64-in. choke, from perforations at 6,688-94 ft. Tubing pressure 1,200 lb., gas-oil ratio reported to be low. Total depth is 6,738 ft. with 7-in. casing set to 6,728 ft.

Magnolia Petroleum Co. 1-B Dennis Hartwell, 8-12s-2w, at West Gueydan field, Vermilion Parish, flowed a potential of 162 bbl. daily through 7/64-in. choke from perforations at 9,544-48 ft., tubing pressure 1,575 lb., gas-oil ratio 700 to 1, gravity 37°. Total depth is 10,440 ft., with 7-in. casing set to 10,438 ft.

WILDCAT FAILURE COMPLETED IN SOUTH LOUISIANA

LaFourche Parish: C. I. Production Co., Inc. 1 Octave Aucion, Lake Long area, 56-17s-19e, dry at 10,500 ft.

EASTERN TEXAS

Pettit Lime Gas Area In Panola Extended

DALLAS.—Amerada Petroleum Corp. 3 Faulk, deep test in the Coke field of northern Wood County, took a 35-minute drill-stem test from 8,085-8,123 ft. The well flowed water cushion in 16 minutes and recoverd 275 ft. of distillate and 180 ft. of mud. Bottom-hole pressure is 3,000 lb. Production is from the lower Rodessa. The Coke field pay is from the Paluxy sand. Sun Oil Co. 1 Williams, John Bowling Survey, 7 miles south of Carthage, extended the Pettit lime gas area of Panola County 3 miles south. The well was completed for 55,000,000 cu. ft. of gas in 24 hours through perforations from 5,998-6,016 ft. and 6,052-64 ft. Total depth is 6,233 ft.

Ohio Oil Co. 1 Popper, wildcat 2½ miles southeast of Cash in Hunt County, on a 1-hour and 50-minute drill-stem test from 8,355-65 ft. recovered 3,000 ft. of fluid. The last 450 ft. was salt water with a slight show of gas. Testing will continue. The Smackover was topped at 9,190 ft. Total depth is 9,390 ft. The Texas Co. 1 Morse, wildcat 1 mile south of Chandler in northeastern Henderson County, is considered dry at 10,643 ft., after a 4-hour drill-stem test at 10,386 ft. in the Travis Peak recovered only gas-cut drilling mud.

W. V. Shaw and C. A. Riddel 1 J. C. Stephens, wildcat 2½ miles north of Easterly in Robertson County, recovered a slight show of oil and fresh water at 1,787 ft. It was drilling below 1,850 ft. in shale. Grubbs, Hawkins & Gilger 1 George, wildcat 4 miles northeast of the Kildare Rodessa Glenrose pool of southern Cass County, is dry in the Travis Peak at 7,477 ft. after electrical log failed to recover any shows.

EASTERN TEXAS WILDCAT FAILURE

Rusk County: Clark & Bolton 1 Kangera Bros., B. W. Heath Sur., 18 mi. SW Henderson, elev. 353 ft., Austin chalk 3,744 ft., Woodbine 3,913 ft., dry, TD 3,970 ft.

APPALACHIAN FIELD

Second Oriskany Test Suggests Stratigraphic Trap

PITTSBURGH.—A second Oriskany test in Knox Township, Columbiana County, southeast Ohio, was completed as a 4,000,000-cu. ft. gas well after shot which now suggests possibilities of a stratigraphic trap of considerable size. It is not believed a local condition as it is over a mile southwest of the discovery well. The new test is Ed Obermiller et al on Galbreath farm in Section 23, Knox Township. Starting at a surface elevation of 1,125 ft., the Oriskany was logged at 3,527-3,553 ft. which places the top of the sand minus 2,402 ft. It is 5,500 ft. S 30° W of the discovery well completed by Ohio Oil Co. on John F. Barnett farm, NE Section 14, which was good for over 5,000,000 cu. ft. of gas. The discovery well started at an elevation of 1,150 ft., derrick floor, with the Oriskany placed at 3,543-3,575 ft. Here, the top of the Oriskany was minus 2,393 ft. or higher than the second test.

About 5,500 ft. N 30° E of the discovery well, Ohio Oil Co. is drilling its second test on Richard Denney farm (mapped F. P. Mullins) in Section 12, Knox Township. It is drilling at 2,700 ft. and should be in the sand within 2 weeks. Ohio Oil Co. has also started spudding a test on Mattie M. Kutz farm, Section 14, Knox Township. Ed Obermiller et al will move to a second location on his 1,600-acre block. Excitement is running high in the area and leases are at a premium. Wildcatting is scheduled extending as much as 6 miles to the northeast and southwest.

In Southwest Pennsylvania, Charles E. Young struck a good showing of oil in a test on George B. Ecroyd farm in North Strabane Township, Washington County. At 2,445 ft., Gordon sand, the 8-in. hole filled up 1,200 ft. with oil. The first day, 135 bbl. were bailed from the hole. It is 2,500 ft. SW of a Gantz sand well on E. G. Walker farm.

In West Virginia, Columbia Carbon Co.'s second test on Gauley Mountain Coal Co. in Falls district, Fayette County, is a gas well gaging 1,770,000 cu. ft. from the Big lime topped at 1,422 ft. with total depth 1,614 ft. The initial test on this tract was dry.

In Scott district, Mingo County, Godfrey L. Cabot, Inc. topped the Oriskany sand at 4,390 ft. in the second test on Summers and Quarrier and struck salt water at 4,436-38 ft. where the hole was bottomed. The Oriskany will be plugged off and the shales shot.

In Mingo County, Columbian Carbon Co. drilled 785 Island Creek Coal Co. to 4,425 ft. with Corniferous lime topped at 4,417 ft. and will plug back to 4,000 ft. and shoot the shale.

In Ravenswood district, Jackson County, Columbian Carbon Co. has started a test of the Oriskany on T. W. Armstrong et al farm located 0.8 mile southeast of the 13,000,000-cu. ft. gas well on J. C. Fisher farm. It starts at an elevation of 657.2 ft.

DAILY AVERAGE PRODUCTION FOR WEEK

	May 5 crude oil	Distillate, allied products	May PAW quota all oils	Apr. 28 crude oil
Alabama	400	.....	300	500
Arkansas	79,800	5,200	85,200	79,800
California	922,450	60,280	1,007,280	918,750
Colorado	10,350	.....	10,500	10,050
Eastern	64,100	6,600	73,800	65,650
Illinois	195,200	12,000	217,000	200,300
Indiana	11,650	.....	13,000	11,700
Kansas	253,150	4,200	278,200	264,600
Kentucky	27,850	2,200	33,200	27,900
Louisiana	370,750	42,000	402,000	366,300
North Louisiana	70,950	.....	.....	71,300
South Louisiana	299,800	.....	.....	295,000
Michigan	45,750	700	47,700	48,000
Mississippi	54,900	.....	53,000	52,400
Montana	23,350	300	23,300	23,100
Nebraska	900	.....	1,000	900
New Mexico	103,650	4,800	109,800	104,550
Oklahoma	384,350	28,500	396,000	363,550
Texas	2,186,150	162,000	2,332,000	2,170,550
East Texas	379,800	.....	.....	378,100
East Central Texas	138,200	.....	.....	145,550
North Central Texas	153,900	.....	.....	150,000
Texas Panhandle	90,000	.....	.....	90,000
West Texas	495,300	.....	.....	489,500
Southwest Texas	365,650	.....	.....	352,150
Texas Gulf Coast	563,300	.....	.....	565,250
Wyoming	102,100	3,200	115,200	103,400
Total United States	4,836,850	331,980	5,198,480	4,812,000
Change from previous week	up 24,850			

Total production January 1 - May 5, 1945 ..... 595,424,250 bbl.
Same period last year ..... 555,372,061 bbl.

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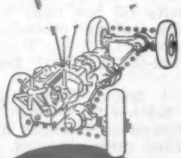

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ILLINOIS

New Pool, Hamilton County And Extension in Wayne

CENTRALIA.—Fifteen oil wells and three dry holes were completed in Illinois pools in the week in review, but five additional dry holes were completed in wildcat areas in various counties of the state. The average initial production of the successful wells was 149 bbl. per day per well.

The largest completion of the week was Pure Oil Co. 1 P. C. Hill, NE NW SW 6-1n-8e, in the Wayne County side of the big Clay City field. It started at 444 bbl. per day from Rosiclare lime at 2,988-3,021 ft., which had been acidized.

Great Lakes Carbon Co. 5 Tully, NW NW SE 21-6s-10e, Concord pool, White County, was good for 398 bbl. initially from McClosky lime at 2,996-99 ft. and 3,035-33 ft.

Six miles southwest of McLeansboro, Hamilton County, Blake Dirickson et al 1 W. C. Pressly, SE SE SW 5-6s-6e, a wildcat 2 miles from other production, was estimated to be good for 200 or more barrels per day from Aux Vases sand at 3,092-3,115 ft. It was not yet completed.

Southwest of the Johnsonville pool Fulk & Craven's 1 Powless, SE SE SE 5-1s-6e, Wayne County, swabbed and flowed 535 bbl. of oil in 15 hours from McClosky lime at 3,250-58 ft. It extends the Johnsonville pool ¾ of a mile. It was not yet completed.

A considerable increase in new operations was noted. Forty-one new starts were recorded, including the following wildcats: Herndon Drilling Co. 1 D. E. Brown, SE SE NW 11-5s-10e, White County; Ryan Oil Co. 1 Walker, NE NE SW 17-2n-6e, Clay County; Robinson & Puckett 1 W. F. Molt-B, SW SE NE 32-1n-8e, Wayne County; Jarvis Bros. and Marcell 1 Hoskins, NW NW SW 31-6s-9e, White County; C. Brehm 1 Dinwiddie, NW SE NW 8-2s-2e, Jefferson County; Carlson & Transeen 1 Swaggler, SW SW NW 10-2n-1w, Clinton County; Joe Dunbar 1 Goecker, NE NW SE 19-7n-7e, Effingham County; Perriott & Sprowles 1 Fritchie, NW NE NW 36-5n-12w, and Olds and Aetna Oil 1 Warner, SE SE SW 1-3n-11w, Lawrance County.

ILLINOIS WILDCAT FAILURES

Effingham County: W. H. Krohn et al 1 Haarman, SW SW SW 25-8n-5e, dry at 2,448 ft. Tar Springs 1,770 ft., Cypress 2,016 ft., Aux Vases 2,206 ft., Ste. Genevieve 2,276 ft.

Jefferson County: A. K. Swan et al 1 Fuller, SW NE NW 13-2s-1e, dry at 2,416 ft. Lower Menard 1,495 ft., Cypress 1,938 ft., Benoist 2,102 ft., Aux Vases 2,181 ft., McClosky 2,362 ft., St. Louis 2,409 ft.

Lawrence County: Perrott & Sprowls 1 Mullins, NE NE SE 35-5n-12w, dry at 1,128 ft. No log.

Sangamon County: J. W. Taft et al 1 fee, N½ NE SE 15-15n-3w, an old well drilled deeper as a Trenton lime test, dry at 2,345 ft., PB to Rosiclaire lime at 816-21 ft. and made a 5-bbl. well. Ste. Genevieve lime at 806 ft., Rosiclaire 816-21 ft., Fredonia 845 ft., Chattanooga 7,754 ft., Devonian 1,785 ft., Maquoketa 2,070 ft., Trenton 2,274 ft.

Wabash County: George Engle 1 McKendree College, SW NW SE 15-1n-13w, dry at 2,820 ft., Glen Dean 2,191 ft., Cypress 2,427 ft., Benoist 2,585 ft., Ste. Genevieve 2,713 ft., McClosky 2,745 ft.

Wayne County: Ashland 1 E. E. McLin, NE SE SW 33-1s-8e, dry at 3,366 ft. Vienna 2,568 ft., Glen Dean 2,658 ft., Cypress 2,956 ft., Aux Vases 3,172 ft., McClosky 3,323 ft.

TEXAS GULF COAST

Jackson County Gets New Discovery

HOUSTON.—A new discovery for Jackson County is the Crown Central Petroleum Corp. 1 W. L. Moody, Jr., about 5 miles southwest of Francitas field, and 14 miles southwest of Palacios, in the Nancy McFarland Survey. It flowed 3 bbl. of 43°-gravity oil per hour through a 6/64-in. choke, tubing pressure 1,025 lb., casing pressure 1,450 lb., from perforations at 8,834-40 ft. Total depth is 9,280 ft.

Josey-Bruton 1 David Rorick, Jr., in H&TC Survey, Section 31, 6 miles northeast of Katy, flowed an ungaged amount of gas condensate through ⅛-in. choke from perforations at 7,040-48 ft. to open new production in Harris County. Total depth is 7,555 ft., with 5½-in. casing set around 7,300 ft. Tubing pressure was 1,600 ft.

General Crude Oil Co. 4 Security Bank & Trust Co., new well at Lane City field in Wharton County, flowed a commission potential of 120.5 bbl daily through ⅛-in. choke, tubing pressure 950 lb., gas-oil ratio 1,610 to 1, gravity 27°, 2 per cent water, from 48 perforations at 5,343-48 ft. Total depth is 5,482 ft., with 5½-in. casing set at 5,480 ft.

Tide Water Associated Oil Co. 1 W. F. Albert, in T. J. Evans Survey, Abstract

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787, northeast offset to the discovery well at Sublime field, in Colorado County, flowed at the rate of 192 bbl. per day on production test, through 5/32-in. choke, from the open hole at 9,530-40 ft. The flow contained 9 per cent b.s. & w. and gravity of the oil is 37. Operators are still testing.

Standard Oil Co. of Texas 1-135 State-Galveston Bay, southwest of production in the northwest extension area at Smith Point field, Chambers County, failed to find commercial production in either the 8,100-ft. or 9,400-ft. sands and was dry at total depth 9,800 ft.

WILDCAT FAILURES COMPLETED IN UPPER GULF COAST

Brazoria County: Jack W. Frazier 1 J. C. Thompson et al, HT&B Sur., 5 mi. northeast of Arcola, dry at 6,964 ft.

Liberty County: Glenn H. McCarthy 1 A. G. Planke, Levi Barrow Sur., Abstract 137, 3 mi. northeast of Hankamer, dry at 8,480 ft.

Matagorda County: J. A. Gray 1 Chas. Boyer, I&GN Sur., Abstract 295, 5 mi. northwest of Midfield, dry at 6,515 ft.

Tyler County: Humble 2-B Denman-Kountze et al, G&BN Sur., Abstract 343, 2½ mi. southeast of Rockland, dry at 8,487 ft.

CALIFORNIA

Elk Hills' Program Nearing Completion

LOS ANGELES.—The Navy Department's development program in Elk Hills Naval Petroleum Reserve No. 1 is nearing completion but it is likely exploratory work will be started soon to determine the potentiality of the remaining untested part of the reserve. Navy engineers have made definite recommendations regarding the areas to be tested and the number of wells to be drilled.

It is not the intention to produce the Hillcrest anticline but merely to determine its importance from a production standpoint. An expenditure of approximately $8,000,000 will be required to drill the proposed 37 new wells to prospect the shallow and deep zones. Present plans contemplate some deep drilling and one or more holes may be carried down into the Eocene which has not yet been penetrated.

Development at Paloma in Kern County indicate the field will be found larger than originally expected particularly along the north flank where considerable black oil sand has been found. Western Gulf Oil Co. 67-6 Los Angeles Athletic Club well appears to have picked up the Paloma sand almost 1 mile east of production at Paloma. Adjacent wells outside the Paloma field are producing from the Symons sand which is stratigraphically higher than the Paloma. It now remains to be determined if Gulf's Athletic club well is on the Paloma structure or whether the company has found a separate accumulation. The Athletic club outpost is the most easterly well drilled to date and the oil sand found is highly important. Three separate zones have been found in this well to date.

WILDCAT FAILURES COMPLETED IN CALIFORNIA

Kings County, Tulare Lake: H. H. Magee 17-1 Von Glahn, 17-23s-22e, bottomed in gray sand, no important showings, TD 4,104 ft.

Kern County, Mountain View: Richfield 26-15-A West Mountain View, 15-30s-28e, bottomed in gray sand, no important showings, TD 6,055 ft.

Solano County, Dixon: Amerada 1 Atkinson, 10-7n-2e, bottomed in gray sand, Dixon sand barren, TD 5,044 ft.

Amerada 1 Comber, 19-6n-2e, bottomed in gray sand and shale, Dixon gas sand barren, TD 6,148 ft.

Yolo County, Davis: Superior 1 Corcoran, 5-8n-1e, bottomed in hard sand and shale, gas prospect well, no important showings, electric log negative, TD 4,646 ft.

N. CENTRAL TEXAS

Ellenburger Test Staked Near Ross Pool

WICHITA FALLS.—Continental Oil Co. 1 Thomas, wildcat 2 miles north of Newport in southeastern Clay County, perforated casing in the Strawn sand from 4,130-50 ft. and swabbed 50 bbl. of fluid, 50 per cent oil and 50 per cent drilling mud, in 21 hours. It is now shut in for storage. Bridwell Oil Co. 1 Vaughn-Holt Unit, wildcat 5 miles southwest of Blue Grove in southwestern Clay, drilled saturated lime from 5,707-11 ft. in the lower Caddo. It is drilling below 5,781 ft. in black shale. Continental 1 Hillin, wildcat 4 miles southwest of Bellevue in southeastern Clay, is dry at 6,821 ft. S. D. Johnson has staked a 5,400-ft. Ellenburger test 1 mile southwest of the Ross pool in western Clay. It is 1 Annie L. Van Arsdale, 330 ft. from the south and west lines of the north half of the Henry McElroy Survey.

Cooke County.—The Texas Co. 1 Murrell, T. Toby Survey, northeast outpost to the company's Ellenburger discovery in northeastern Cooke, northwest of the Walnut Bend pool, swabbed 14 bbl. of oil and 11 bbl. of salt water, swabbing 4,300 ft. from the top. The well is being tested

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from 5,398 ft., where casing is set, to total depth of 5,494 ft. in the Ellenburger.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCAT

Cooke County: Extension to old oil pool—R. W. Fair & Sons 4 A. D. Walterschied, E. Langford Sur. A-566, 5 mi. S and 2 mi. W Muenster, elev. 1,010 ft., pumped 98 bbl. day, perf. 3,044-47 ft. Ellenburger, PB 3,048 ft., gravity 41°, gas-oil ratio 100, TD 3,108 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: G. W. Cooper 1 W. P. Ferguson, Sec. 2, SPRR Sur. A-1200, 2 mi. E and 1 mi. N Mankins, Ellenburger, 4,711 ft., dry, TD 4,845 ft.

Geo. Stogner, Tr. 1 W. H. Thomas, Lot 10, Nathan Thomas subd., 3 mi. W and ½ mi. N Archer City, elev. 995 ft., dry, TD 1,378 ft.

Cooke County: H. D. Egger 1 Milton Wade, J. Worley Sur. A-1129, 3 mi. E and 2 mi. N Valley View, elev. 643 ft., Ellenburger 2,354 ft., dry, TD 2,407 ft.

Burk Royalty Co. 2 T. J. Holcomb, A. C. C. Bailey Sur. A-44, 4½ mi. E Gainesville, elev. 830 ft., dry, TD 2,390 ft.

Jack County: Hanlon-Buchanan 1-B J. H. Shown, Lot 2, J. B. Irvine Sur. A-312, 5 mi. SE Antelope, dry, TD 3,680 ft.

WEST CENTRAL TEXAS WILDCAT FAILURE

Eastland County: Kerlyn Oil 1 Fenten, James Lahee Sur. No. 17, 5 mi. N Pioneer, elev. 1,775 ft., dry in Ellenburger, TD 3,785 ft.

SOUTHWEST TEXAS

Goliad County Test Will Be Deepened

CORPUS CHRISTI.—Transwestern Oil Co. 1 William Altman Estate, wildcat 15 miles north of Goliad and 2 miles south of the Slick field, in Goliad County, B. P. Tumlinson Survey, made a drill-stem test in top of Wilcox at 7,648-52 ft. using 800-ft. water cushion, ¼-in. chokes, 27 lb. working pressure, recovered water cushion and 4,500 ft. of pipe-line oil, in 30 minutes. Operators cored ahead to the present depth of 7,678 ft. and recovered little more sand. The well will be drilled to 7,715 ft. and then start coring again. Now shut down to repair rig.

W. Earl Rowe et al (De Lange) 5 Mrs. N. B. Davis, Yougeen field, Bee County, recovered 36 stands of oil, no water, on 20-minute drill-stem test on perforations at 3,840-41 ft., using 3/16-in. bottom and ⅛-in. top chokes. Total depth is 3,845 ft. with 5½-in. casing set at 3,845 ft. Operators are now running tubing to complete.

Continental Oil Co. (formerly Navarro Oil Co.) 1 Forrest A. Dahl, wildcat, 3½ miles northwest of Pettus, in Geo. Fagan Survey, Bee County, recovered 10 ft. of condensate and 20 ft. of fresh muddy water on a 6-minute drill-stem test at 6,825-30 ft., using ¼-in. chokes and 500 lb. working pressure. Operators are now coring ahead at 6,830 ft.

Shell Oil Co., Inc., 1 Mary J. Myrick, in GC&SF Survey 719, Brooks County, on 24-hour potential test, flowed 76.15 bbl. 51.8°-gravity oil through 9/64-in. choke, tubing pressure 900 lb., casing pressure 1,200 lb., gas-oil ratio 2,180 to 1, from eight perforations at 5,176-78 ft. Total depth is 7,026 ft., with 5½-in. casing at 6,540 ft.

WILDCAT FAILURES COMPLETED IN SOUTHWEST TEXAS

Bee County: Hewitt & Dougherty 1 T. W. Wolfe, T. B. Barton Sur., 10 mi. west of Pettus, dry at 7,515 ft.

Bee County: Rowan & Hope 1 J. T. Borroum Estate, J. M. Planes Sur., 4 mi. east of Beeville, dry at 4,317 ft.

McMullen County: Quintana Petroleum 2-F South Texas Syndicate, Jas. Fitzpatrick Sur., Sec. 14, 16 mi. southeast of Fowlerton, dry at 3,968 ft.

Starr County: V. F. Neuhaus and J. A. Tarver 1 H. P. Guerra et al, Porcion 79, ¾ mi. northwest of Rio Grande City, dry at 916 ft.

Wilson County: Quintana Petroleum 1 Annie L. Moore, David O. Warren League, 4 mi. southwest of Dewville, dry at approximate depth of 7,270 ft.

Zapata County: Geo. H. Echols 2 Volpe Estate, Porcion 31, Share 1, 8½ mi. northeast of Zapata, dry at 3,311 ft.

MICHIGAN

Gusher and Dry Hole For Deep River Field

SAGINAW.—Characteristically, last week Arenac County's Deep River field activities resulted in one gusher completion, with the well's initial potential rated at 6,000 bbl. a day, while in a nearby section another completion was a dry hole.

Four other small producing oil wells were among the week's 15 completions, which included three gas wells, one of them a small producer classed as a wildcat, and seven dry holes, five of which also were wildcat tests.

For the first time in months no completion was listed for the prolific Coldwater pool in Isabella County; instead an 8,460,000 cu. ft. gasser was brought in in that township. The new North Plains develop-

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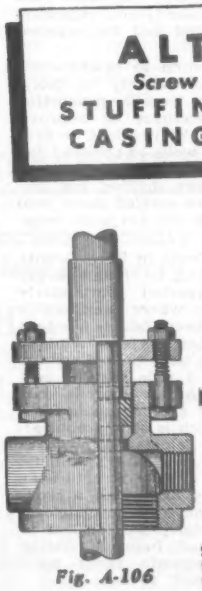

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ment in Ionia County gave further promise as a Section 5 oil test was completed for an initial flow of 70 bbl. a day.

A dozen new drilling permits were issued by the state conservation department. Four locations are in Mecosta County, two each in Missaukee and Allegan counties, one each for Arenac, Montcalm, Alcona and Gladwin counties.

MICHIGAN SUCCESSFUL WILDCAT

Clare County, Surrey Township: Michigan Consolidated Gas 1 Frizzell et al, NE 23-17n-5w, gas well, 613,000 cu. ft., TD 1,464 ft.

MICHIGAN WILDCAT FAILURES

Allegan County, Manlius Township: J. R. Van Annam 1 Brandt, NW SW NE 28-3n-15w, dry in Traverse limestone, TD 1,380 ft.

Arenac County, Whitney Township: Sun Oil 1 Van Horn, NW NW SW 26-20n-7e, dry in Dundee, TD 3,489 ft.

Ionia County, Lyons Township: Fox Hole Oil 1 Roose, N½ N½ NE 33-7n-5w, dry in Dundee, TD 2,828 ft.

Kent County, Byron Township: Michigan Devonian Petroleum 1 Van Ess, SE NW NW 10-5n-12w, dry in Traverse limestone, TD 1,792 ft.

Osceola County, Osceola Township: Sun Oil 1 Bieri, N½ SE NE 32-18n-8w, dry in Dundee, TD 3,834 ft.

ROCKY MOUNTAIN

Crook's Gap Offset Is Better Than Discovery

DENVER.—The Crook's Gap pool in Fremont County, Wyoming, in which Sinclair-Wyoming Oil Co. made an important discovery last November in the Lakota sand at 5,232-72 ft., for 1,478 bbl. per day, is showing for an even bigger well in 2 Unit, NW SE NE 13-28n-93w, a west offset to No. 1 and a near completion. Four drill-stem tests were taken in the Dakota and coring is going ahead at 5,059 ft. in the top of the Lakota. The first test was at 4,917-43 ft., open 15 minutes, with a recovery of 2,894 ft. of oil and 57 ft. of drilling mud through a ¼-in. choke. It built up a flowing pressure during the 15 minutes of 1,925 lb. The shut-in pressure was 2,175 lb. The oil showed a gravity of 39.6°, which compares with 36.2° in the discovery well in the Lakota. The second test, open 15 minutes at 4,941-78 ft., recovered 2,920 ft. of oil and 50 ft. of drilling mud through the ¼-in. choke. The third test was at 4,978-5,012 ft., open 15 minutes, and resulted in recovery of 3,322 ft. of oil and 50 ft. of mud through the ¼-in. choke. The fourth test was at 5,013-47 ft., and in 15 minutes recovered 2,625 ft. of oil and 50 ft. of mud through the choke. The drill at this depth went into green shale. The discovery well upon completion last November flowed 1,478 bbl. through the 2½-in. tubing in 24 hours. The second well is expected to do much better.

South Elk Basin Wildcat.—Continental Oil Co. 1 Ida Goodstein, NE SE SW 20-57n-99w, South Elk Basin, 3 miles south of the Elk Basin pool, is still testing at 7,166 ft., and flowing approximately 50 bbl. per hour of 28° gravity oil from the Tensleep and not showing any water. It is expected, however, to do much better before it is finally completed, as the hole gives evidence of greater capacity than has so far showed up in the tests. Top of the Tensleep was at 6,960 ft.

Kevin-Sunburst extension.—Consolidated Gas Co. 1 Gillespie, SE NW SE 15-35n-4w, midway between the Kevin-Sunburst and Cut Bank fields, Toole County, Montana, which last month opened a new high west of the Rimrock pool, 2 miles ahead of Kevin-Sunburst production, pumped 100 bbl. of oil and 100 bbl. of water on April 23 and 100 bbl. of oil and 165 bbl. of water on April 25. In initial test it pumped approximately 15 bbl. pipeline oil per hour through the 2½-in. tubing. It had the Ellis-Madison contact at 2,332 ft. and was drilled to 2,341 ft.

Baggs wildcat starting.—Texas Co. is building derrick for its 1 Baggs Unit, NE SE SE 35-13n-92w, Baggs anticline, southern Carbon County, Wyoming, which will be an important test on the Tertiary beds. Location is an offset to the S. Marvin James discovery well which made 20,000,000 cu. ft. of gas per day from a sand in the Wasatch at 2,160 ft. several years ago. The new test will explore deeper horizons.

WYOMING SUCCESSFUL WILDCAT

Park County, Little Buffalo Basin: Stanolind 6 Unit, NE NE NW 1-47n-100w, TD 4,975 ft., 7-in. 4,915 ft., swabbed 14 bbl. per hour, 92 per cent oil, from Tensleep, outpost ½ mile north nearest producer.

WYOMING WILDCAT FAILURES

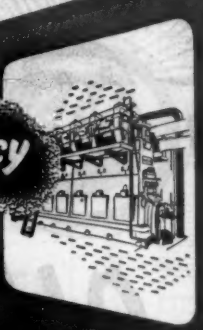
Park County, Frannie: Continental 1 State, NE NE NW 36-58n-96w, TD 3,199, top Tensleep 3,015 ft., dry in Tensleep, outpost on southern flank.

Half Moon: Husky Refining 1 Geiger, NW NW NE 26-51n-102w, TD 1,073 ft., dry, did not reach objective, down structure.

MONTANA WILDCAT FAILURE

Teton County, Willow Creek: Union Oil 1 Yeager, SE SW SE 21-24n-6w, TD 3,596 ft. Tops: Eagle 650 ft., Colorado 1,060 ft., Kootenai 2,665 ft., Sunburst 3,230-40 ft., dry; Ribbon sand 3,308-80 ft., show of oil; Ellis 3,308 ft., Madison 3,488 ft., dry.

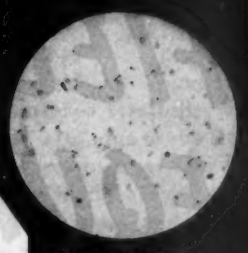
DIRTY FUEL OIL DESTROYS Diesel Engine Efficiency



● Every operator knows that when pumps or injection parts become worn, proper combustion is seriously impaired. Improper combustion means lowered engine efficiency and increased maintenance in lapping pumps and reconditioning injection parts.

The tolerances in fuel oil pumps and injection parts are so precise that even the most microscopic abrasive will cause damaging wear. It is not a matter of straining out the nuts and bolts, but *all abrasives, regardless of size, must be removed.*

Many fuel oil filters now in use as both standard and auxiliary equipment on diesel engines are not capable of removing damaging abrasives. The relative efficiency of fuel oil filters is graphically presented in Figures 1 and 2 below.



Results of conventional strainer type filter

FIG. 1—Micro-photo shows 45 times enlargement of the abrasives in one cc. of refined fuel oil. Sample taken after it had passed engine filter ready for injection. Chemical analysis showed—Moisture 3.5%, sediment .035%, tarry matter .0475%.

Results accomplished by Honan-Crane Fullers Earth fuel oil Purifier

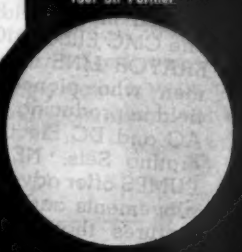


FIG. 2—Micro-photo shows 45 times enlargement of contamination in one cc. of the same refined fuel oil after passing one time, full flow, through Honan-Crane Fuel Oil Purifier. Chemical analysis showed—Moisture .005%, sediment .0035%, tarry matter .003%.

● It is important that any operator of diesel engines check the efficiency of his fuel oil filtering or purifying facilities. Proper combustion will quickly pay for the change to an efficient fuel oil filtering system.

Honan-Crane fuel oil purifiers are available for direct connection or bulk station use for the purification of both refined and crude fuel oils. Write for complete information and engineering bulletin on purification of Diesel Fuel Oils.

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206 WABASH AVENUE, LEBANON, INDIANA

CANADIAN FIELDS

Turner Valley Well Flows 18 Bbl. Per Hour

CHATHAM.—In West Central Turner Valley, Pacific Petroleums, Ltd., 8, LSD 14, 35-19-3w5, finished at 8,479 ft., with Madison limestone at 8,238 ft. and flowed 18 bbl. per hour after partial acidizing. Okalta Oils, Ltd. 16, LSD 15, 35-19-3w5, TD 7,962 ft., PB to 7,835 ft., is making around 150 bbl. In the Turner Valley north extension, Home Oil Co., Ltd.-Millarville 18, LSD 7, 18-21-3w5, finished at 9,083 ft. with Madison at 8,362 ft. and is making 505 bbl. daily.

Coalspur.—In the northern Alberta foothills, west of Edmonton, Imperial-Coalspur 1, LSD 10, 3-49-21w5, has definitely established a depth record for Canada, drilling below 12,499 ft. compared with a maximum depth of 12,056 ft. previously attained in Shell Oil Co. of Canada-Norman 1 in the Jumping Pound area. Imperial-Coalspur 1 is in the Fernie shale, and believed close to the Madison limestone.

PERMIAN BASIN

Gulf Will Drill 10,000-Ft. Test in Crockett County

MIDLAND.—Amerada Petroleum Corp. 1-A E. H. Jones, wildcat 7 miles northwest of the Russell pool and in the extreme northwest corner of Gaines County, took a 95-minute drill-stem test from 8,869-8,920 ft. and recovered 150 ft. of oil and gas-cut mud and 150 ft. of water-cut drilling mud. Then a 55-minute drill-stem test was taken from 8,914-40 ft. The packer failed and 200 ft. of oil-cut mud and 400 ft. of drilling mud was recovered. It is being drilled ahead. Humble Oil & Refining Co. 1 Humble-Shell, 1-mile east extension of the Doss pool in southern Gaines, has been completed through perforations from 7,065-7,175 ft. for 48 bbl. of 34.9° gravity oil in 24 hours. Gas-oil ratio was 231 to 1. Total depth is 7,184 ft. DeKalb Agricultural Association, Inc. 1 Nora F. Colthorp, southeast outpost to the Doss pool, ran a 1-hour and-55-minute drill-stem test from 6,035-6,110 ft. and recovered 420 ft. of drilling mud with no shows. It was drilling below 6,113 ft. in lime.

Continental Oil Co. D-1-133 W. R. Settles, deep test in the Howard-Glasscock field in Howard County, perforated from 9,100-9,200 ft. On a 2-hour-and-15-minute drill-stem test, 800 ft. of water cushion and 1,900 ft. of 43°-gravity oil was recovered. This is believed to be in the Pennsylvanian. Total depth is 10,122 ft. The Texas Co. 1 W. T. Coble, 2 miles west of the Levelland pool in western Hockley County, injected 4,000 gal. of acid from 4,840-60 ft. and swabbed 162 bbl. of fluid, 36 per cent basic sediment and acid residue and 64 per cent oil, during the last 18 hours. It is still being swabbed and tested.

Sinclair-Prairie Oil Co. 1 Jennie McKnight, wildcat in northwestern Crane County, is dry at 10,884 ft. in Ellenburger. Honolulu Oil Corp. 1 Richardson, 1½ miles southeast of Elmer Hitt, recent northeast extension to the P.H.D. pool, Garza County, swabbed 11 bbl. of oil with a small amount of drillin water at total depth of 3,522 ft. It is being tested further.

WEST TEXAS SUCCESSFUL WILDCATS

Andrews County: New oil pool—Stanolind 1-P University, Sec. 44, Blk. 13, University lands, 3 mi. S Fullerton pool, elev. 3,301 ft., PB 8,789 ft., flowed 439 bbl. day through ¼-in. choke on 2-in. tubing, perf. 8,750-70 ft. Devonian, gas-oil ratio, 1,109, gravity 44°, TD 8,855 ft.

Pecos County: Extension to old oil pool—Texas 1 Ernest Riggs, Sec. 8, Blk. 146, T&St.L. Sur., 2 mi. NW Ft. Stockton pool, IP 169 bbl. day through ¼-in. choke, perf. 2,885-2,903 ft., top pay 2,840 ft. Yates, gravity 35°, TD 2,903 ft.

Terry County: New oil pool—Leland Fikes and John Murchison 1 C. A. Alexander, Sec. 18, Blk. K, PSL Sur., 6 mi. SW Slaughter field, elev., 3,554 ft., pumped 150 bbl. day, perf. 5,088-5,157 ft. St. Andres, gravity 32°, TD 5,157 ft.

WEST TEXAS WILDCAT FAILURES

Andrews County: DeKalb Agricultural Assn. 2 C. A. Shultz, Sec. 5, Blk. C-45, PSL Sur., NE outpost Means pool, elev. 3,167 ft., dry, TD 4,654 ft.

Magnolia 1-A Ralph, Sec. 20, Blk. A-31, PSL Sur., 1 mi. W Fullerton pool, elev. 3,344 ft., Devonian 8,114 ft., Simpson 9,935 ft., Ellenburger 10,655 ft., dry, TD 10,991 ft.

Crane County: Sun Oil 1 Mrs. J. B. Robberdeau, Sec. 19, Blk. 35, H&TC Sur., 3 mi. NW Crossett pool, elev. 2,370 ft., Ellenburger 6,338 ft., dry, TD 6,415 ft.

Edwards County: Shell 1 Honeycutt, Sec. 7, Cert. 155, TC Sur., 13 mi. NW Rock Springs, elev. 2,200 ft., Ellenburger 7,218 ft., Cambrian 8,886 ft., dry, TD 8,931 ft.

Glasscock County: Weiner & Petty 1 W. P. Edwards, Sec. 11, Blk. 34, T-2-S, T&P Sur., 3 mi. W Howard-Glasscock pool, elev. 2,510 ft., dry, TD 965 ft.

Howard County: Northern Ordnance 1 Spaulding, Sec. 7, Blk. 33, T-2-N, T&P Sur., elev. 2,651 ft., Cisco 5,995 ft., dry, TD 7,202 ft.

Terry County: Stanolind 1-B Land &

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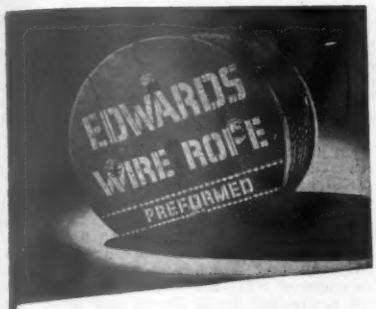

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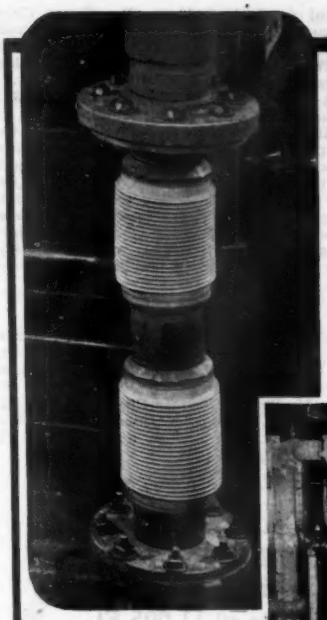
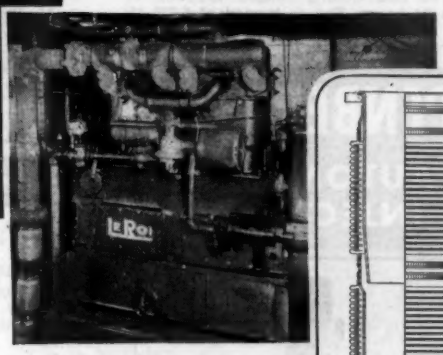
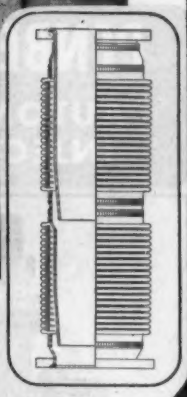


EXCESSIVE CORROSION + VIBRATION





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Plants: Maywood and Elgin, Ill.

Mortgage Co., Sec. 17, Blk. C-37, PSL Sur., elev. 3,240 ft., Grayburg 4,300 ft., dry, TD 7,012 ft.

Upton County: J. W. Ellis & Son 1 A. S. Burleson Est., Sec. 76, Blk. 35, H&TC Sur., 1½ mi. S McCamey, elev. 2,447 ft., dry, TD 2,305 ft.

Yoakum County: Honolulu Oil 2-B-75 Hudson, Sec. 75, Blk. D, John H. Gibson Sur., 2½ mi. SW Slaughter field, San Andres 4,380 ft., dry, TD 5,210 ft.

PANHANDLE WILDCAT FAILURE

Deaf Smith County: Humble 1 Hyslop, 18-3n-1e, 35 mi. W Hereford, elev. 4,448 ft., Clear Fork 5,190 ft., Pennsylvania 6,090 ft., dry, TD 7,915 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Samedan Oil Co. 1 Boyd, a 2-mile northwest extension to the Drinkard pool in Lea County, gaged 197 bbl. of oil in 24 hours. Pay is topped at 6,370 ft. Total depth is 6,455 ft. The Texas Co. 1 Blinebery, northeast offset to the Drinkard discovery well, with total depth of 7,517 ft. in granite, is now running electrical survey. Phillips Petroleum Co. 4 Lea-Mex, wildcat northeast of the Maljamar field, is drilling below 11,691 ft. in lime and shale unchanged. This is the deepest test that has been drilled in New Mexico. Continental Oil Co. 3-B-23 Skaggs, in the Skaggs deep area, is drilling below 7,530 ft. after completing fishing job. Humble Oil & Refining Co. 2 Federal-Leonard, Ordovician test in the Dublin area of southeastern Lea, was drilling below 8,622 ft. in shale and lime.

SOUTHEASTERN NEW MEXICO WILDCAT FAILURES

Lea County: El Paso Natural Gas 1 Ramsco-State, 36-16s-35e, elev. 3,964 ft., Grayburg 4,050 ft., San Andres 4,415 ft., TD 4,575 ft.

C. M. Pearce 1 State-Cities Service, 31-16s-33e, 1½ mi. N Roberts pool, elev. 4,245 ft., San Andres 4,880 ft., dry, TD 5,303 ft.

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OKLAHOMA

Important Major County Test Dry at 11,005 Ft.

SUPERIOR OIL CO. OF CALIFORNIA was preparing to abandon 1 Norris, NE cor. 17-19n-10w, a wildcat on a large block in Major County, Oklahoma, after drilling to 11,005 ft. with no production of oil or gas. The total depth is estimated, as the well was drilled as a "tight" hole.

Magnolia Petroleum Co. 1 Cunningham, C SE SE 33-5n-6w, Grady County, one of the most interesting wells of the year, was shut in at the week end waiting for pipe-line facilities. Opened in the course of the week it made 243 bbl. of distillate in 20 hours, 317 bbl. in 24 hours and 147 bbl. in 8 hours and 45 minutes, all through chokes ranging from ¼ in. to 14/64 in. The distillate tested 54 degrees at the well. Production is from basal Pennsylvanian sand with pipe perforated at 10,879-882 ft. The well shows a productive capacity as high as 6,000,000 cu. ft. of gas per day.

Texas Co. finally completed its extension to the West Marlow pool in Stephens County. It is 1 Sears, C SE NE NE 20-2n-8w, and was good for 215 bbl. through 7/32-in. choke from pay at 6,714-61 ft., total depth 6,762 ft.

Phillips Petroleum Co. made a location for a test on the Oklahoma City Municipal Airport land which will be known as 1 Airport, C NE NE 8-12n-4w, 2 miles south of production in 33-13n-4w and 2¾ miles northwest of Phillips & Kerlyn 1 Classen in C NW SE 22-12n-4w, gas and distillate producer and discovery well of the Bethany area. Phillips, Kerlyn and Magnolia were nearing the Hunton lime in 1 Ella, C NE NE 22-12n-4w, about ½ mile northeast of the discovery well.

OKLAHOMA SUCCESSFUL WILDCATS

Bryan County: New Oil Pool—Amerada et al 1 Williams, NE NE SW 27-6s-7e, flowed 167 bbl. in 24 hours through 7/8-in. choke from sand at 2,910-3,005 ft., TD 3,257 ft., McLish lime 3,230 ft.

OKLAHOMA WILDCAT FAILURES

Caddo County: Texas 1 Warden, SE SE SE 17-8n-10w, dry, TD 10,334 ft., Medrano 9,545 ft.

Comanche County: Texas 1 Weaver, NE SW SE 19-4n-10w, dry, TD 6,441 ft.

Ellis County: Sinclair Prairie 1 Berryman, NE NE NE 3-17n-24w, dry, TD 4,282 ft., Chase 3,985 ft.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that lots 3, 4, and the NE¼SW¼ sec. 31, T. 25 S., R. 37 E., N.M.P.M., 119.86 acres within the known geologic structure of the Jal Field, New Mexico, are offered as a single parcel to the responsible qualified bidder of the highest cash bonus per acre for lease under section 17 of the mineral leasing act, as amended by the Act of August 21, 1935 (49 Stat. 674, 30 U. S. C. 226). Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington 25, D. C., up to 12 noon, May 18, 1945. Each bidder must submit a certified check or cash for one-fifth of the amount bid, payable to the order of the Treasurer of the United States, and file the showing of qualifications to receive a lease required by section 7 of Circular No. 1386. The remainder of the bonus and the annual rental at the rate of $1 per acre must be paid and a $5,000 coroprate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bid by the Secretary of the Interior. The envelopes should be plainly marked "Bid for lease in Jal Field, New Mexico. Not to be opened before noon, May 18, 1945." No bid received after the time fixed herein for submitting bids will be considered. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color or national origin, and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the N½N½ sec. 23, NW¼NW¼ sec. 24, T. 20 S., R. 34 E., N.M.P.M., New Mexico, 200 acres within the known geologic structure of the North Lea oil field, are offered as a single parcel to the responsible qualified bidder of the highest cash bonus per acre for lease under section 17 of the mineral leasing act, as amended by the act of August 21, 1935 (49 Stat., 674, 30 U.S.C. sec. 226). These tracts are within the unit area of the approved North Lea unit agreement, but any lease issued pursuant to this sale will not be made subject to the terms of the unit agreement, and the successful bidder will not be required to file evidence that he has entered into an agreement with the unit operator for development and operation of the lands under the unit agreement, but will be permitted to operate the lands independently of the unit operator as long as the present conditions prevail. Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington, D. C., up to twelve noon May 16, 1945. Each bidder must submit a certified check or cash for one-fifth of the amount bid payable to the order of the Treasurer of the United States and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1 per acre must be paid, and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bid by the Secretary of the Interior. The envelopes should be plainly marked "Bid for lease, North Lea oil field, New Mexico. Not to be opened before noon, May 16, 1945." No bids received after the hour fixed herein for submitting bids will be considered. The successful bidder will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U.S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

Garvin County: C. W. Roodhouse et al 1 Warren, SE SE NE 34-4n-1e, dry, TD 3,850 ft., base Pennsylvanian 3,820 ft.

Logan County: Hill & Hill 1 Datin, NE NE SE 11-16n-4w, dry, TD 4,898 ft., Layton 4,847 ft.

Oklahoma County: British-American 1 Reece, NE NE NE 18-14n-1w, dry, TD 6,140 ft., second Wilcox 6,109 ft.

Payne County: Wilcox 1 Ross, SE SE SW 29-19n-6e, dry, TD 3,645 ft., Wilcox 3,599 ft.

Stephens County: H. Paramore 1 Branch, SW SW SW 31-1s-7w, dry, TD 2,596 ft., in sand.

W. S. Merrick 1 Dilley, SW NW SW 13-3s-5w, dry, TD 2,662 ft., Arbuckle 2,560 ft.

Washita County: Gulf 1 Shields, SE NW SE 11-8n-20w, dry, TD 7,200 ft.

MISSISSIPPI

Sunniland Field Well Cores Oil Show

TALLAHASSEE.—In the Sunniland field in Collier County, Florida, Humble Oil & Refining Co. 4 Gulf Coast Realty Co., 1,996 ft. south and 2,054 ft. west of NE corner of 20-48s-30e, has cored lime and dolomite showing oil in porous streaks at 11,559-82 ft. A drill-stem test was attempted at 11,556-86 ft., but failed. Preparations are being made to retest. The oil show logged in this well is about 40 or 50 ft. higher than in the discovery well.

Reports of saturation in the Eutaw formation in H. H. Hamilton 1 Richie, NE NE 3-12n-12e, Neshoba County, Miss., were found erroneous, after stirring considerable interest. Ether tests on samples developed that streaks of lignite were present. A drill-stem test at 2,310-38 ft. failed.

MISSISSIPPI WILDCAT FAILURES

Adams County: Humble 2 Stowers, 35-9n-2w, dry, TD 7,000 ft., tops not available.

Webster County: P. M. Barton & Joe E. Skelton 1 Skelton, 200 ft. south and 660 ft. west of NE corner of NE NE 6-21n-11e, dry, TD 2,910 ft. in Paleozoics, Eutaw 1,290 ft., Tuscaloosa 1,595 ft.

LA.-ARK.

Delhi South Extension Makes 262 Bbl. Per Day

SHREVEPORT.—Gulf Oil Co. 1 Hopper, NW NE 28-17n-9e, south extension to the Delhi field in Richland Parish, is being completed for 262 bbl. per day. Production is from the Paluxy sand, from perforations at 3,327-42 ft. Total depth of the well is 3,454 ft.

In Bienville Parish, the Ohio Oil Co. 1 Walker, 31-17n-7w, prospective discovery, recovered 90 ft. of oil and 235 ft. of oil-cut mud in a drill-stem test at 6,789-6,816 ft. In coring ahead, oolitic lime with faint odor was recovered.

Arkansas operations feature two interesting wildcats this week, one in Columbia County, and the other in Union County. Mayfield Drilling Co. 1 Woodard, SE NE 6-17s-19w, in Columbia County, northwest of the Village pool, drill-stem tested in the Smackover at 7,399-7,416 ft. Recovery was 19 stands of oil-cut mud with brackish taste, and three stands of salt water.

In Union County, Tide Water Associated Oil Co. and Seaboard Oil Co. of Delaware 1 Griffin, NW SE 33-18s-16w, cored at 6,775-85 ft., and showed stain, and at 6,805-13 ft., the core showed odor. Pipe has been set at 6,885 ft.

NORTH LOUISIANA WILDCAT FAILURE

Caldwell Parish: Atlantic 1 Tremont, 881 ft. north and 990 ft. east of SW corner of 6-13n-2e, dry, TD 6,175 ft.

OHIO, KENTUCKY

Offset to Discovery Is Gas Dual Completion

COLUMBUS.—Pure Oil Co. 1 George Hofstatter, Section 10, Perry Township, Coshocton County, drilled Clinton sand at 3,155-3,212 ft. with a total open flow of 1,000,000 cu. ft. of gas from two pays. The completion is the first offset to the discovery well.

Ohio Fuel Co. 1 M. V. Miley, Section 33, Ripley Township, Holmes County, extends the Big Prairie gas pool ½ mile to the south. Clinton sand at 3,164-3,186 ft. gaged 713,000 cu. ft., and sand at 3,192-3,207 ft. gaged an additional 1,617,000 cu. ft.

Obermiller 1 J. F. Galbreath, Section 23, Knox Township, Columbiana County, has drilled through the Oriskany sand with a gage of 600,000 cu. ft. before shot. The well is one mile southwest of the discovery.

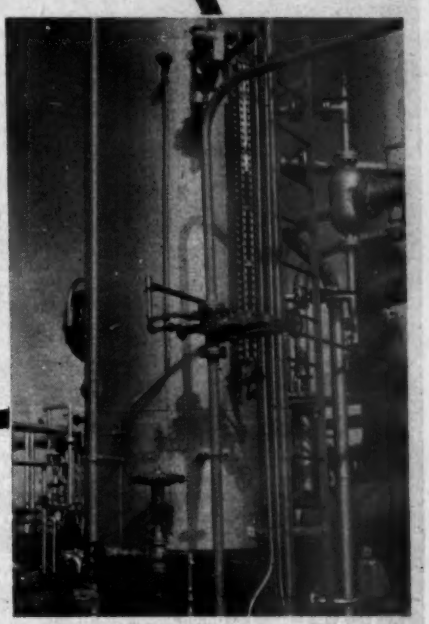
OHIO WILDCAT FAILURES

Hocking County, Green Township: Preston Oil 1 Rugg Brandt, Section 31, Clinton 2,798-2,831 ft., dry, TD 3,002 ft.

Muskingum County, Blue Rock Township: Industrial Gas 10 I. J. Miller, Section

JERGUSON

Liquid Level Readings for the Eye to See and Believe



THE Reflex Gage provides maximum visibility because of the sharp black-white contrast between liquid and space above. The liquid level can be spotted quickly and at a distance. It's the most "readable" gage available.

The Transparent Gage is more useful if the condition or color of the liquid as well as its level must be checked. Light rays pass through the liquid in contrast with the reflex gage where the rays are reflected and refracted.

Standard JERGUSON Reflex Gages are designed for pressures up to 3200 pounds at 100° F. or up to 1200 pounds at 1000° F. Transparent Gages are designed for pressures up to 2000 pounds at 100° F. or up to 600 pounds at 1000° F. Each can be assembled in sections to meet any desired vertical range.

JERGUSON GAGE & VALVE CO.

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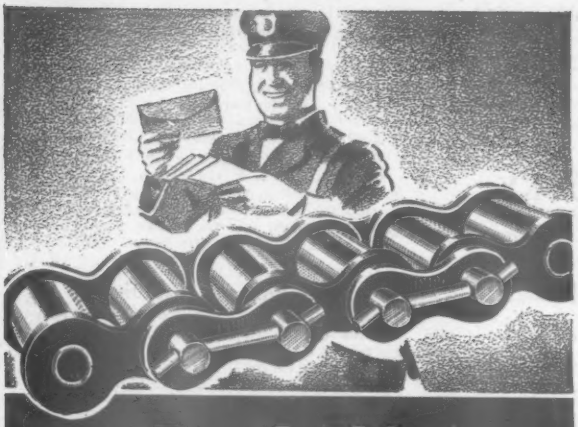

Read This "Chain Letter"

Dear Chain User:

After a gratifying experience, have you used the expression, "How long has this been going on?" We hear it every now and then from first-time customers in the petroleum industry.

The chief reason our Oil Field Chains make such firm friends is that we are chain specialists, content to manufacture a complete line of steel chains, sprockets and flexible couplings. Then, too, we get a kick out of helping friends use chain properly, so that it often gives more service than they expect.

This has been going on for many years now and if you haven't already given Union Oil Field Chains a trial, it's high time.

THE UNION CHAIN AND MANUFACTURING COMPANY
SANDUSKY, OHIO, U.S.A.

Union Oil Field Chain for Every Application

A. P. I. No. 3⅛ P Union *Superintendent* No. 3125-R
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A. P. I. No. 4 P Union *Jumbo* No. 1240-SXX
A. P. I. No. 4 P Union *Toolpusher* No. 1240-RXX
A. P. I. No. 4 P Union *Driller* No. 1240-R 4
A. P. I. No. 4 C Union *Roughneck* No. 1240-RX
A. P. I. No. 3 P Union *Toolpusher* No. 1190-RXX
A. P. I. No. 3 P Union *Driller* No. 1190-R 3
A. P. I. No. 3 C Union *Roughneck* No. 1190-RXS

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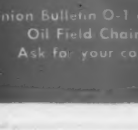

Union Bulletin O-1 covers Oil Field Chain. Ask for your copy.

UNION CHAINS

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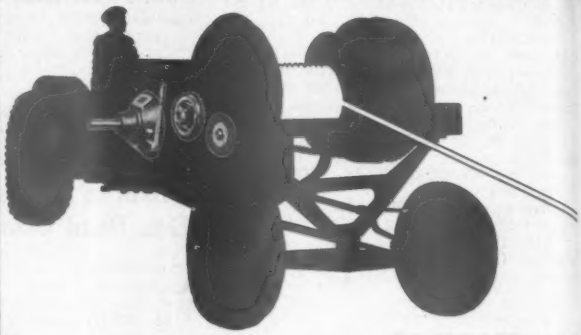

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It shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacitity tables, dimensions and complete specifications. Every production engineer will find help in this handy bulletin, when planning postwar products.

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WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended May 5, 1945					Cumulative total, 1945				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	0	0	0	2	2	0	0	6	24	30
Indiana	0	0	0	0	0	2	0	0	7	9
Illinois	0	0	0	6	6	16	0	0	85	101
Kentucky	0	0	0	0	0	2	0	1	14	17
Michigan	0	0	1	5	6	2	0	1	79	82
Kansas	1	0	0	9	10	13	0	6	109	128
Neb., Mo., Iowa	0	0	0	0	0	0	0	0	9	9
Oklahoma	0	0	0	10	11	31	0	4	98	133
Texas:										
North Central	1	0	0	6	7	35	0	3	163	201
West	3	0	0	9	12	24	0	0	106	130
Panhandle	0	0	0	1	1	0	0	1	4	5
Eastern	0	0	0	1	1	5	2	0	31	38
Gulf Coast	0	0	0	6	6	22	1	11	88	123
Southwest	0	0	0	4	4	9	1	3	57	70
Total Texas	4	0	0	27	31	95	5	18	449	567
Louisiana:										
Northern	0	0	0	1	1	1	1	2	23	27
Southern	0	0	0	1	1	11	0	0	16	27
Total Louisiana	0	0	0	2	2	12	1	2	39	54
Arkansas	0	0	0	0	0	0	0	0	15	15
Mississippi	0	0	0	2	2	3	0	0	42	45
Ala., Ga., Florida	0	0	0	0	0	0	0	1	8	9
Montana	0	0	0	1	1	5	0	0	7	12
Wyoming	1	0	0	2	3	8	0	0	14	22
Colorado-Utah	0	0	0	0	0	0	0	0	3	3
New Mexico	0	0	0	2	2	5	0	2	23	30
California	0	0	0	5	5	1	0	2	71	74
Total United States	7	0	1	73	81	195	6	43	1,096	1,340
Total previous week	9	0	2	79	90					

27, Clinton 4,465-4,480 ft., dry, Medina 4,548-4,557 ft., dry, TD 4,568 ft.

EASTERN KENTUCKY OPERATIONS

ASHLAND. — Seven well completions were recorded in eastern Kentucky operations during the week ending May 1, four of the completions being marked "dry hole" and the combined estimated daily production of the remaining three oil wells totaling 20 bbl.

In the largest of the operations, Ashland Oil & Refining Co. completed No. 8 on the J. W. Gillen farm in Lawrence County on Rocky Branch, at a depth of 816 ft., with estimated daily production of 8 bbl.

KANSAS

Harper County Test Swabbing After Acid

LION Oil & Refining Co. 1 Muir, rank wildcat and prospective discovery in SE SE SE 10-31-8w, Harper County, is now swabbing after acidizing with 3,000 gallons. Perforations were made at 4,395-99 ft. with 45 shots, in the Mississippi lime, and 2 bailers of fluid per hour were bailed. After treatment with 1,000 gallons acid, the well swabbed one-half bbl. of oil per hour. Perforations at 4,399-4,403 ft., with 47 shots, yielded an estimated 7 bbl. of oil per day by bailing. Treatment was given with 3,000 gallons acid, and operators are swabbing. Tops on the well are Lansing 3,664 ft., Mississippi lime 4,389 ft., Kinderhook 4,590 ft., Viola 4,755 ft., and Arbuckle 4,931 ft. Total depth is 5,051 ft.

Barber County: Cities Service Oil Co. 1 Smith, SE SE SE 24-30-13w, in the northern part of the county, took a drill-stem test in the Viola, and had a show of gas. The test was taken at 4,474-95 ft. A previous test in the Lansing, at 3,825-40 ft. recovered 170 ft. of mud with a show of oil. Operators are now drilling below 4,600 ft. Tops on the well are Lansing 3,845 ft., Mississippi lime 4,289 ft., and Viola 4,474 ft.

KANSAS SUCCESSFUL WILDCATS

Barton County: New Oil Pool—Solar Oil 1 Behrens, N/2 SW NE 6-20-15w, potential 250 bbl. per day from Arbuckle at 3,729-33 ft., TD 3,755 ft., Anhydrite 1,000 ft., Kansas City 3,382 ft., Arbuckle 3,659 ft.

KANSAS WILDCAT FAILURES

Barton County: Black-Marshall 1 Korkisch, NE NE SW 35-16-12w, dry, TD 3,426 ft., cherty conglomerate 3,380 ft.

W. L. Hartman 1 Hoffmeister, SW SW NW 25-20-13w, dry, TD 3,595 ft., Simpson 3,520 ft.

Butler County: Skelly 1 Kennel, NE SE NE 20-28-7e, dry, TD 2,810 ft., Mississippi lime 2,799 ft.

Texas 1 Hutchings, SE SE SW 26-27-3e, dry, TD 3,105 ft., Arbuckle 3,060 ft.

Graham County: Helmerich & Payne 1 Miller, SW SW SW 5-9-21w, dry, TD 3,823 ft., Arbuckle 3,777 ft.

Pawnee County: Continental 1 Norris, SE SW NE 9-22-20w, dry, TD 4,702 ft., Arbuckle 4,636 ft.

Reno County: Kingwood Oil 1 Hilger, NW NW NE 29-26-4w, dry, TD 4,210 ft., Arbuckle 4,156 ft.

Rice County: Keyes Drilling 1 Zink, SE SE SE 34-18-10w, dry, TD 3,310 ft., Arbuckle 3,266 ft.

Sedgwick County: Rinehart Engineering et al 1 Larsen, SW SW SE 16-25-3w, dry, TD 4,684 ft., Arbuckle 4,117 ft.

FOREST CITY BASIN

ST. JOSEPH, Mo.—Turner 1 fee in NWC SE NW 4-47n-32w, Jackson County, Missouri, was dry at 441 ft. Fell & Reid 1 Fred Klam, in C SE SE SE 10-51n-33w, Platte County, Missouri, northwest of Parkville, was shut down in the Viola lime at 1,554 ft.

R. S. Tomer Producing Co. 1-A Livengood in NE SW SW 3-1s-15e, Brown County, Kansas, which is expected to be the third producer in the new Morrill pool, was drilling below 1,775 ft. This is 1,320 ft. south of the discovery well. The second well, 1 Husted, was 22 ft. lower than the first when drilled 1,320 ft. north of the discovery well.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the N½N½ sec. 21, T. 16 S., R. 29 E., N.M.P.M., New Mexico, 160 acres within the known geologic structure of the North High Lonesome field, is offered as a single parcel to the responsible qualified bidder of the highest cash bonus per acre for lease under section 17 of the mineral leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U.S.C. sec. 226). Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington 25, D. C. up to twelve noon, May 17, 1945. Each bidder must submit a certified check or cash for one-fifth of the amount bid payable to the order of the Treasurer of the United States and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1 per acre must be paid and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bid by the Secretary of the Interior. The envelopes should be plainly marked, "Bid for lease, North High Lonesome field, New Mexico. Not to be opened before noon, May 17, 1945." No bids received after the hour fixed herein for submitting bids will be considered. The successful bidders will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U.S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C. Notice is hereby given that the lands herein described within the known geologic structure of the Derby Dome oil field, 6th P. M., Wyoming, are offered to the responsible qualified bidders of the highest cash bonus per acre for lease under section 17 of the Mineral Leasing Act., as amended by the act of August 21, 1935 (49 Stat., 674 30 U.S.C. sec. 226), in the following parcels: Parcel No. 1, T. 31 N., R. 98 W., sec. 4, NW¼SW¼, 40 acres; Parcel No. 2, T. 31 N., R. 98 W., sec. 9, N½NE¼, 80 acres; Parcel No. 3, T. 31 N., R. 98 W., sec. 4, lot 4; sec. 5, lot 1; T. 32 N., R. 98 W., sec. 32, E½SE¼; sec. 33, W½SW¼, SE¼SW¼, 282.69 acres; total 402.69 acres. The NE¼NE¼ sec. 9 in Parcel No. 2 is in a public water reserve and included in an outstanding water well lease and any oil and gas lease covering this tract will contain a provision for conducting all drilling and other operations in such a manner as not to impair its value as a public watering place or to be detrimental to the public interests. Sealed bids will be received in the office of the Commissioner of the General Land Office, Interior Building, Washington 25, D. C., up to twelve noon, May 14, 1945. Bids must be submitted on each parcel separately, but if two or more parcels are awarded to the same bidder they may be combined in a single lease. Each bidder must submit a certified check or cash for one-fifth of the amount bid payable to the order of the Treasurer of the United States and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1 per acre must be paid, and a $5,000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned upon acceptance of the successful bids by the Secretary of the Interior. The envelopes should be plainly marked "Bid for Parcel No. ——, Derby Dome oil field, Wyoming. Not to be opened before noon, May 14, 1945." No bids received after the hour fixed herein for submitting bids will be considered. The successful bidders will be required to agree not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U.S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.

WEIGHT INDICATOR POINTS

GET FULL DRILLING INFORMATION

When you install a "Sealtite" it indicates and records weight on bit, mud pump pressure, and torque in drill pipe. Rotary table speed is indicated and recorded so you know you're drilling a better well at less cost. This master drilling instrument really controls operations instantly, accurately *at all depths on any well.*

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STOP LEAKS This Easy, Better Way!

Apply RECTORSEAL with a brush or swab to threads and gaskets directly from the container . . . no stirring . . . no mixing.

It retains its plastic elasticity, sealing off every crack and crevice for the life of the connection. And when breaking-out, the connection will not be "frozen," because RECTORSEAL keeps its lubricating qualities as well as sealing properties indefinitely.

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THE POSITIVE LEAK PREVENTER

Among the Drilling Contractors

Jefferson Oil & Gasoline Co. is the firm name of a new drilling and producing company that has been formed with David J. Flesh, Shreveport; Sam Y. Dorfman, Sam B. Sklar, and Robert Brown as equal owners. First activity is scheduled for the Jefferson area of Marion County, Texas.

Regent Drilling Co., Ltd., Vermilion, Alta., has a contract for several wells to be drilled for Borradaile Oils, Ltd., on its holdings at Lloydminster, Alta.

E. J. Simonais, **Kern Drilling Corp.,** has been appointed secretary of the California branch of the American Association of Oil Well Drilling Contractors, with headquarters at Long Beach.

Camay Drilling Co. has been awarded the drilling contract and has already started work on a second well Texas Co. is drilling in the West Del Valle field where it recently found a new accumulation of oil and gas. The new well, the 41-18 Kern, will be located close to the discovery well.

Can-Tex Drilling Co., Calgary, Alta., has completed drilling Taber-Province 45-15-A, LSD 10, 15-9-17w4, in the Taber field for California Standard, and is testing production at 3,210 ft.

Newell & Chandler, Calgary, Alta., are finishing Mid-Continent East Crest 3, LSD 1, 8-6-15w4, in the Conrad field, southern Alberta, with production expected in the Ellis sand below 3,128 ft.

Virginia Drillng Co. has staked location at 1 Berglund, C SE SE 1-17-4w, Ellis County, Kansas, 4 miles southwest of production in the Ruder pool.

Mike McEvoy is the contractor on the Frank E. Roush 1 State of Michigan, in SE SE SE 21-20n-6e, Arenac County, Michigan.

Crowe Drilling Co. has the contract on the Jay Kornfeld et al 1 Lindell, in NE NE SE 34-16-3w, a Saline County, Kansas, wildcat test. Location is 2½ miles northeast of

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when you drill out cement, it will remove the sheath

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of hardened cement, also any scale, and dangerous

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burrs left from gun perforating. This leaves your cas-

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ing clean, smooth, and safe so it cannot damage rub-

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bers, packers or swabs, or interfere with future "down-

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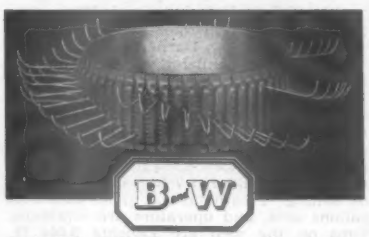
the-hole" operations. No serviceman required. Reasonable rental basis.

Look on Page 357 of the 1944 BAKER, or Composite Catalog, for the BAKER ROTARY CASING SCRAPER



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Designed and tested to work up to their *rated capacity* without distortion. Ample strength without undue weight eases derrick man's work and speeds round trips.

SEE COMPOSITE CATALOG PAGES 3101 TO 3120

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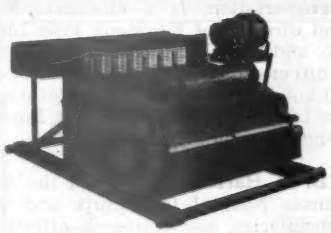

Handles the output from 20" mud pumps after surface hole is drilled. Average capacity 650 gallons per minute. Completely unitized. Screening surface—16 square feet. Domestic shipping weight less drive—1600 pounds. Headroom—27 inches. See Composite Catalog or write for details.

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the Lindsborg pool production. Surface pipe has been set at 140 ft.

Don Ingling is the drilling contractor on the Wood River Oil & Refining Co. 1 Huberty, in SW NW 2-16-12w, Barton County, Kansas. Test is 1 mile north of production in the Kraft-Prusa pool.

H. H. Blair is the drilling contractor, and also has part interest in the Fred Smith 1 Brown, in NW NW SE 6-14-14w, Russell County, Kansas. Test is being drilled with cable tools.

Mouser Drilling Co., contractor on the Ainsworth and others 1 Fenn, in SW SW NE 7-19-14w, Barton County, Kansas. Location has been staked approximately 3 miles northeast of Heiser, Kans.

Simpson-Noble Drilling Co., contractor on the W. N. Bartlett and others 1 Zabradnik, in SE SE NW 18-15-10w, Ellsworth County, Kansas, has completed the test as a dry hole at 3,344 ft.. Test is 4 miles north of production in the Stoltenberg pool.

Hannum Drilling Co. has the drilling contract on the Max Cohen 1 Langer, drilling below 2,200 ft. in NW NW NE 4-21-14w, Stafford County, Kansas. Test is 1 mile southwest of production in the Prichard pool.

A. W. Hutchings has the drilling contract and was moving in materials for the Davidor & Davidor 1 Wadlington, in C SW NE 18-12n-1e, Marengo County, Alabama. Test is a farmout from Lion Oil Refining Co.

C. B. Miller has been awarded drilling contract on the Alan W. Winchester 3 P. E. Fleecer, in SW NE NW 27-3n-13w, Allegan County, Michigan.

E. W. Leeder is the contractor on the Alan W. Winchester 1 A. and K. Van Klompenberg, in SW NE SE 11-4n-14w, Allegan County, Michigan.

Union Drilling Co. will drill the Taggart Brothers Co. 1 Haddix-Denslow, in C NE 2-16n-8w, Mecosta County, Michigan.

Gordon Oil Co. will drill three tests in Mecosta County, Michigan, for Michigan Consolidated Gas Co. They are the 1 Gertrude Burns et al, in C SW 5-15n-9w; the 1 Charles Hansen et al, in C NE 8-15n-9w, and the 1 Lucht-Bush, in C NW 9-15-9w.

Delta Drilling Co. is the contractor on the Sinclair Wyoming Oil Co. 1 W. D. Griffith, in C NE NE NE 36-1n-17e, Clarke County, Mississippi.

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"REFLEX"
WATER GAGE SET

For oil field, locomotive type and marine boilers. Water shows black—steam shows white; the water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass replaced by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. Conforms with A.S.M.E., Federal and State requirements when used for pressures specified by their respective codes.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

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Faster, Safer
Wire Rope Work

Simplex No. 322 Cable Reel Jack. Capacity 10-tons, lift 13¾", height 29"; for reels 42" in diameter.

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PERSONALS

Inventive Bent One Of Omar Cavins' Many Talents

OMAR A. CAVINS, assistant general superintendent of the producing department, northern district, for Standard Oil Co. of California, joined that organization in 1917 shortly after graduation from University of California, where he had majored in mining. Before and during his college course Cavins worked in oil fields as a roustabout and tool dresser, and he did a short hitch as a railroad brakeman.

From 1921 to 1925 Cavins was in Mexico and Texas doing land-examination work for Standard of California. His time was occupied largely with special coring, well-surveying problems and patents. In 1928 he became production foreman at Elk Hills. From 1931 to 1936 he was assistant manager, and then manager, of the company's organization and cost-control division in San Francisco. In the latter year he assumed his present post.

Cavins has obtained patents on oil-well tools and well-surveying devices. He collaborated in the preparation of University of Texas Bulletin 2748, "The Cretaceous and Tertiary of Southern Texas and Northern Mexico."

Dr. Frank C. Whitmore, dean of the school of chemistry and physics at Pennsylvania State College since 1929, has been awarded the William Gibbs Medal by a national jury of chemists in recognition of outstanding contributions as an organic chemist. The award is made annually. Aviation fuels, lubricants and synthetic rubber have been subjects of special study by him.

Mrs. Bea McCune, Denver, has been appointed chief scout for the Rocky Mountain area for the California Co., headquarters in Denver. She is the first woman to have such a position in that area.

Ed Catron, of the Bay Petroleum Co., formerly at Wichita, Kans., has been appointed district land man for that company with headquarters at Casper, Wyo.

R. V. LeSueur, K.C., president of Imperial Oil, Ltd., Toronto, Canada, was also elected chairman of the board at the company's annual meeting last week, succeeding **G. Harrison Smith. O. B. Hopkins,** head of the geological department; **R. J. White,** economic coordinator; **F. C. Mechin,** head of the employes relation department, and **C. E. Carson,** superintendent of refineries, were added to the board increasing its membership to eight.

Frederick A. Bush, chief geologist for Sinclair Prairie Oil Co., has been transferred from Tulsa to the company's principal offices in New York, which hereafter will be headquarters for the chief geologist. Bush joined the company 19 years ago as a stratigrapher and was elevated to his present post in 1931.

T. L. Fontaine, chief clerk of the production department of Humble Oil & Refining Co. since 1933, resigned May 1 to enter private business in Houston. Fontaine went to work for Humble in 1927 as secretary to **John R. Suman,** now vice president of Standard Oil Co. (New Jersey).

Jack Danciger, vice president Danciger Oil & Refining Co., Tulsa and Fort Worth, received the Order of the Aztec Eagle at ceremonies in Fort Worth May 1. The honor was conferred by Gen. Avila Camacho, president of Mexico, in recognition of work done by Danciger in cultivating better understanding and closer friendship between Mexico and the United States.

Lt. Frederick Dimit, Bartlesville, Okla., employed by Phillips Petroleum Co. before he entered military service, demonstrated there is more than one way to bomb the Japanese. When a 500-lb. bomb failed to leave its rack during a B-29 raid, Lieutenant Dimit crawled back from his bombardier's post and found a bomb shackle stuck, with no way to free it. He just lifted the 500-pounder and dropped it through the open bay upon the Japanese homeland 14,000 ft. below. The young officer's father is **C. P. Dimit,** vice president in charge of production for Phillips.

Lester C. Hannon, Tulsa, and **Harry Dyer** and **Leo A. Stokes,** Oklahoma City, have incorporated the Hannon Oil Co., with headquarters in Tulsa.

J. Earle Brown, consulting geologist and producer of Fort Worth, has been elected a director and vice president of the South Shore Oil & Development Co. of Chicago.

H. G. Schad, a director and general manager of transportation for The Atlantic Refining Co., was made a vice president last week. Schad, who joined Atlantic in 1925 as assistant to the general manager of transportation, is a vice president and director of Keystone Pipe Line Co. and Buffalo Pipe Line Corp. and a director of Atlantic Pipe Line Co., all subsidiaries of Atlantic Refining. He is also a director of War Emergency Tankers, Inc.

D. W. Harris, president of the Arkansas Natural Gas Corp. and its subsidiaries, has resigned, effective May 17. **A. H. Weyland,** vice president and general manager, has been designated chief executive officer of Arkansas Natural. **H. T. Goss** will succeed Weyland. **M. J. Lasseigne** will be treasurer of the company and subsidiaries. The resignation of **B. R. Muirhead** as treasurer of the company was announced at the same time. **T. W. Tutweiler,** chief engineer in charge of operations for Cities Service Co. and its subsidiaries, will take over the presidency of the Arkansas Natural Gas Corp.

Joe H. Field, formerly with Gulf Oil Corp., has joined the Sohio Petroleum Corp. as mechanical and

equipment engineer, with headquarters in Oklahoma City.

Russell R. Robison, who has been acting chief mechanical engineer at the Los Angeles office of Shell Oil Co., Inc., has been transferred to Shell's Canadian office as acting division superintendent, exploration department.

John S. Parker, Los Angeles, and **G. B. Yarberry,** Long Beach, both of whom are to leave soon for Colombia, in the service of Tropical Oil Co., were among foreign guests at the April meeting of the Los Angeles chapter of Nomads. Others were **R. B. Block,** International Petroleum Co., Talara, Peru; **John Daniell,** McCarty Co., Los Angeles, formerly connected with Canol project; **Donald H. Meek,** U.S.N.R., Los Angeles, assigned to Alaska for new development work projected by U. S. Navy; **J. W. Mitchell,** International Ecuadorian Petroleum Co., Guayaquil, Ecuador, and **Charles T. Blanchet,** Richmond Petroleum Co., San Francisco.

E. D. Kenna, of Jackson, Miss., has been elected executive vice president and secretary treasurer of the Mississippi-Alabama division of the Mid-Continent Oil and Gas Association.

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LUBRICATING DEVICES

Glass body oilers, sight feed lubricators. Plain oil and grease cups, spring compression and screw plunger grease cups, engine lubricators . . . these are among the Penberthy lubricating devices that are so widely used in the oil industry because they have always been dependable under the most severe conditions.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

MARKET QUOTATIONS

Prices as of May 8, 1945

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gallon.)

REFINERY GASOLINE

Octane (A.S.T.M.)	76†	70-74
Mid-Continent*	6.75	5.875
Gulf Coast	6.75	5.625
Northeast Coast	....	9.075
California	....	6.50-7.00

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.500	5.400
North Texas (f.o.b. plant)	4.125	4.950
North Louisiana (f.o.b. plant)	4.375	5.250
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.18
Illinois Basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.08

Note: Exclusive of subsidy.

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma Kansas	Gulf Coast Texas	West Tex.*
18-18.9	$0.80	....	....	....
19-19.9	.84	....	$1.06	$0.70
20-20.9	.88	$0.85	1.08	.72
21-21.9	.92	.87	1.10	.74
22-22.9	.96	.89	1.12	.76
23-23.9	1.00	.91	1.14	.78
24-24.9	1.03	.93	1.16	.80
25-25.9	1.07	.95	1.18	.82
26-26.9	1.11	.97	1.20	.84
27-27.9	1.15	.99	1.22	.86
28-28.9	1.18	1.01	1.24	.88
29-29.9	1.20	1.03	1.26	.90
30-30.9	1.23	1.05	1.28	.92
31-31.9	....	1.07	1.30	.94
32-32.9	....	1.08	1.32	.96
33-33.9	....	1.11	1.34	.98
34-34.9	....	1.13	1.36	1.00
35-35.9	....	1.15	1.38	1.02
36-36.9	....	1.17	1.40	1.04
37-37.9	....	1.19	1.42	1.06
38-38.9	....	1.21	1.44	1.08
39-39.9	....	1.23	1.46	1.10
40 and above	....	1.25	1.48	1.12

*Includes Lea County, New Mexico.

A.P.I. REFINERY REPORT

Week ended April 28, 1945

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Distillate	Stocks: Residual
East Coast	743	14,051	5,796	5,961
Appalachian	172	3,711	521	332
Ill., Ind., Ky.	767	23,086	3,798	1,759
Okla., Kan., Mo.	389	9,540	1,803	1,163
Inland Texas	243	2,902	330	777
Tex. Gulf Coast	1,158	15,038	5,955	5,817
La. Gulf Coast	221	4,679	1,496	1,382
North La., Ark.	83	2,917	688	232
Rocky Mountain	113	2,463	306	639
California	891	15,681	7,580	21,751
Total 4-28-45	4,780	*94,068	28,273	39,813
Total 4-21-45	4,676	95,104	28,219	40,492
Total 4-29-44	4,329	88,305	30,146	50,631

*Military 43,102; Civilian 50,966.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
April 28, 1945	223,474,000
April 21, 1945	222,929,000
April 29, 1944	235,342,000

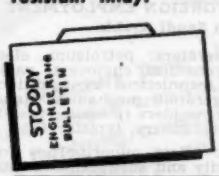
*Excludes unrefinable California stocks.

Doubles tool joint life

For fifteen years Tube Borium has been used on drilling bits to increase cutting speeds and drill more out-to-gauge hole. Now you can use this same alloy to greatly prolong the life of your tool joints!

An exceedingly small quantity of Tube Borium welded in a ring around the shoulder not only doubles tool joint life—even under the toughest operating conditions—but maintains over all joint strength and correct elevator contour. Applications are economically made on both new and resleeved joints.

APPLICATION: Accepted method of application is to under-cut new or resleeved joints at the shoulder to form a recess ⅛" deep by 1½" wide. The recess is then filled by welding in with ¼" Electric Tube Borium to form the wear resistant inlay.



Write for this special Stoody engineering bulletin describing in detail hard-facing procedures on tool joints—no obligation.

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STOODY HARD-FACING ALLOYS
Retard wear . . . Save Repair

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WANTED by consulting organization. Petroleum engineers with Hayward mud logging experience or its equivalent. Immediate openings in Venezuela, excellent opportunity for advancement to managerial positions throughout the world. Box A-290, The Oil and Gas Journal, Tulsa, Okla.

EASTMAN Oil Well Survey Company has position open for field Sales and Service man in Louisiana Gulf Coast area. Applicant must have good knowledge of and be well acquainted in oil and drilling industry. Attractive salary. Expenses and car furnished. Address written applincation to Box 890, Lafayette, Louisiana.

DRILLERS
Steady work, good wages, water wells year round, Bucyrus machines, essential to war effort, draft exempt. Apply — Gray Well Drilling Co., Inc., Box 181, Phone 1051, Delafield, Wisconsin.

ENGINEER for field consultation and sales work, by manufacturer of refinery and power plant equipment. Age 25 to 35. Excellent future prospects. Box A-501, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER capable of designing line of Centrifugal Pumps for refinery application. This engineer is required by a long established pump manufacturer. Excellent opportunity for right man. State experience, age, and salary desired. Write Box A-523, The Oil and Gas Journal, Tulsa, Oklahoma.

MAINTENANCE INSPECTOR for refinery located in Middle West. Must have cracking unit experience. Permanent position and excellent opportunity for competent man. State age, experience and salary desired. Box A-522, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED plane table engineer, would prefer personal interview. Laughlin-Simmons & Co., 615 Oklahoma Natural Gas Building. Phone 3-5985, Tulsa, Oklahoma.

ENGINEERS WANTED: Graduate Ch.E., M.E., or E.E., 20 to 29 years of age, having refinery or laboratory experience. Essential industry with post-war continuance. State education, experience, salary expected and date of availability. P.O. Box 2546, Houston 1, Texas.

WANTED

Metallurgist

Electrical Instrument Engineer

(preferably with E.E. degree)

Rockbit Designer

by one of largest oil tool manufacturers in Southern California. Specify which position you are applying for. Send complete data about yourself in first letter. Fine opening for right men. Salary open. Address Box A-531, The Oil and Gas Journal, Tulsa, Oklahoma.

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in Saudi Arabia

Refinery operators; petroleum, electrical and mechanical engineers; radio operators and technicians; air-conditioning and refrigeration mechanics; stabilizer operators; welders (pressure-vessel-pipeline); stenographers; typists.

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If genuinely interested in foreign career, send full information on experience, transcript of college record (professional applicants only), references, draft and availability status to our Employee Relations Department.

ARABIAN AMERICAN OIL COMPANY
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HELP WANTED

ESTIMATING ENGINEER: Major petroleum company in Chicago. Must have oil refining, operating, or construction experience. Box A-529, The Oil and Gas Journal, Tulsa, Oklahoma.

MATERIAL MAN: Major oil company desires material man for foreign service, with thorough knowledge of the purchase, receipt, warehousing and accounting for oil field equipment. Reply Box 2819, Dallas 1, Texas, giving full details of education and experience.

WANTED
DIRECTOR OF LABORATORY

By manufacturer of rust preventives and specialty petroleum products, recognized leader in its field. Location—Chicago. Should be available as soon as possible. Excellent postwar opportunity and attractive renumeration.

NOX-RUST CORPORATION
2429 S. Halsted St., Chicago 8.

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ENGINEERING
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Applicants must conform with Local War Manpower Regulations. State full details of training, experience, and availability in first letter.

THE STEARNS-ROGER MANUFACTURING CO
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SITUATIONS WANTED

COMPETENT, Warehouseman, Field Clerk, Material and Inventory Man, 41 Years Old With General Office Experience Desires Connection. Box A-510, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION Superintendent, 48, capable, reliable, sober, fifteen years experience with difficult deep wells, engineering graduate, wants employment with aggressive Mid-Continent operator. Box A-520, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATION WANTED: CHEMICAL ENGINEER—BS 1940—MS 1942. Capable young man desires responsible supervisory position in petroleum or allied industry. 3 years undergraduate analytical chemist. 5 years varied post graduate experience. Past 2½ years design and operation of large scale crude topping and vacuum lube unit. Age 31, married, draft 2B. Present salary $4000. Salary desired, $6000. Box A-517, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE engineer, 17 years electrical and mechanical experience, largely with oil industry, desires permanent supervisory position commensurate with experience and training. Box A-518, The Oil and Gas Journal, Tulsa, Oklahoma.

SUPERINTENDENT of Refinery, 20 years experience in Refinery Engineering, design, developing of processes and supervision. Desiring change, preferrably south. Box A-528, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE GEOLOGIST and Registered Civil Engineer, Age 39, experienced in supervision, design, field and construction engineering desires responsible position. Available on short notice. Box A-530, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE Petroleum Engineer, ten years experience, gas and condensate production, reservoir engineering, valuations, desires permanent position and salary commensurate with experience. Box A-534, The Oil and Gas Journal, Tulsa, Oklahoma.

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PATENTS, Trade-Marks, Booklet, "General Information Concerning Inventions and Patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 418, Bowen Bldg., Washington 5, D. C.

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DESIROUS of purchasing one or two Askania Vertical Magnetometers, new or old model. Address: Box A-521, The Oil and Gas Journal, Tulsa, Oklahoma.

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2½ INCH PIPE
Also other sizes of pipe and tubes
Write, wire or phone
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Kansas City 18, Kansas.

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1—INGERSOLL Rand portable air compressor, 315 C.F.M. capacity on 4 steel wheels. Driven by Waukesha Motor Equipped for Natural Gas or diesel fuel. A-1 Condition. SAPULPA TANK CO., P.O. Box 218, Sapulpa, Oklahoma.

FOR SALE: Model 200-R. T. Sullivan Core Drill. Current Model mounted on D246-7 International Truck. 58 foot derrick, 5 x 6 Gardner-Denver Pump, powered by two 95 H.P. Motors. Complete with all drilling accessories for drilling to 2,000 feet. Write or wire Box 1193, Monahans, Texas.

FOR SALE: 2—Used 26" x 20" Clark Cylinders Complete. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

FOR SALE: Two Waukesha Drilling engines, 180 H.P. equipped with gasoline starting motors. R. L. Melton, Seminole, Okla.

FOR SALE: 6x6x6x12 Ingersoll-Rand Compressor and 80 HP Bessemer Engine including belt, connections, coils, etc. Excellent condition. Near Bartlesville. Price $1650. Write 45 Oil Co., Bartlesville, Oklahoma.

ONE practically new Model FDM Franks Slim Hole or shallow production Portable Unitized Drilling Unit, mounted on large tandem truck, with all necessary drilling equipment, ready to put to work. Will sell for 80% of actual cost. Box 572, Odessa, Texas.

FOR SALE: 1—SC-12-A Oil Well Pump jack with weights, and 35 H.P. motor. 1—Lamtex 4" casing pump with 1600' ⅞ rods. 2—210 bbl. welded tanks, 1—10' x 18' cypress hay tank, 1—2" x 20 tube heater. Box A-532, The Oil and Gas Journal, Tulsa, Oklahoma.

WILSON Mogul Compound Rotary Drilling Rig, complete and in good condition. Powered with two D-13000 Caterpillar motors—with or without 94' Lee C. Moore cantilever mast. Same as new. Can furnish approximately 4,000' of new 4½ inch drill pipe or 5,000' of new 3½ inch drill pipe or 4500' of used 4½ inch drill pipe. NEAL AMMONS, 209 First National Bank Building, Mt. Vernon, Illinois.

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12#—exceptionally good quality
36" gauge, 25# portable Tracks
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120 HP., 3 cyl., 327 RPM., Diesel.
120 HP., Engine-Generator set, 327 RPM., 480 Volt, 60 cyc., 3 phase.
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Three light steam rotary rigs, capable of drilling 3,500'; one Fairbanks-Morse powered rotary rig having 8" Johnson drawworks, captable of drilling 5,000'. All located in Oklahoma Panhandle gas field. If interested, inquire:

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